The Electrical Industry's Weekly Magazine December 11, 1961

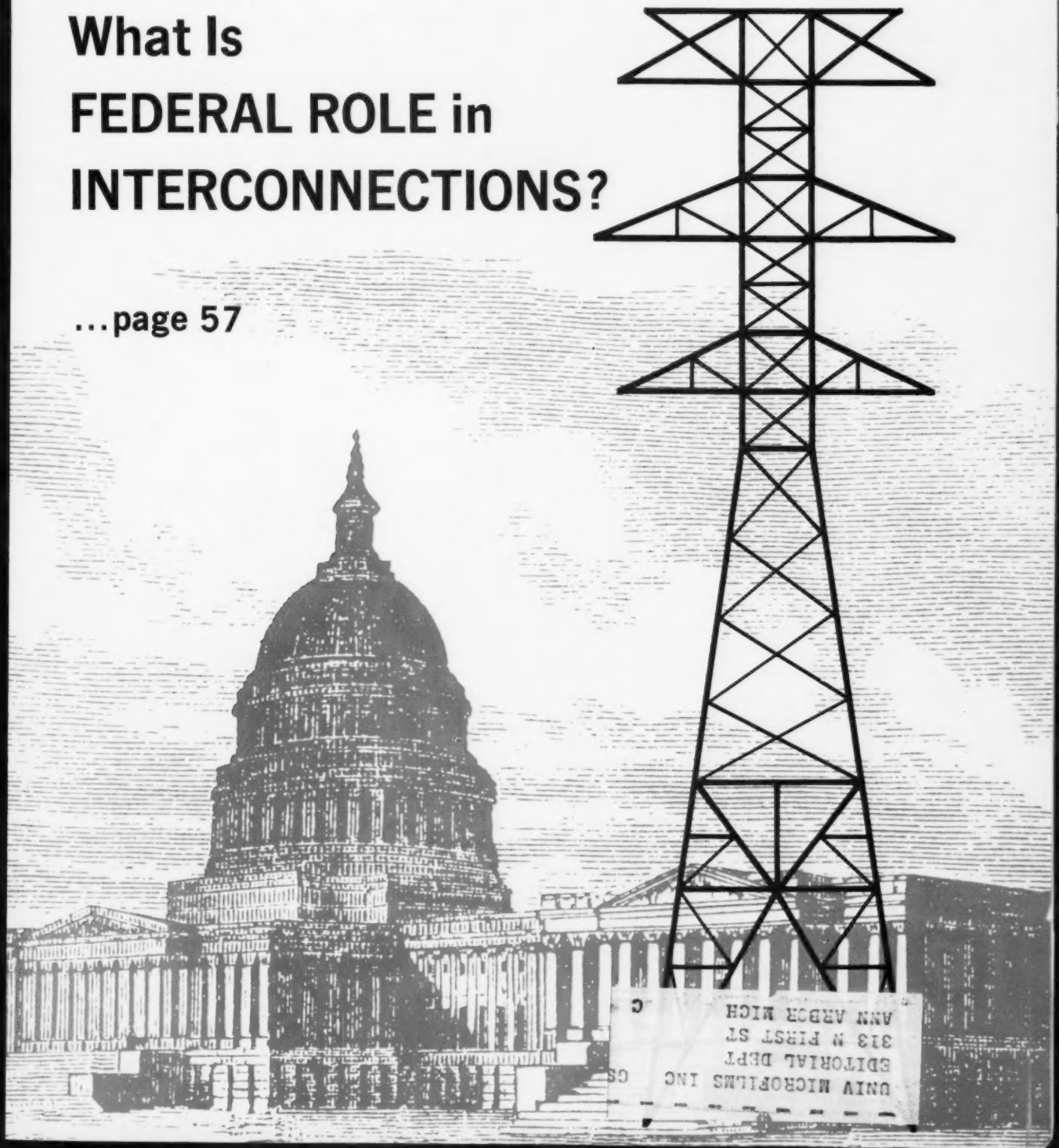
Electrical World

Price 50 Cents

A McGraw-Hill Publication

What Is FEDERAL ROLE in INTERCONNECTIONS?

...page 57



UNIV MICROFILMS INC
EDITORIAL DEPT
313 N FIRST ST
ANN ARBOR MICH

Undetected flame failure can cause costly interruptions, do serious damage to expensive equipment and endanger lives. To prevent such loss, Honeywell has developed an ultraviolet flame detector that won't be fooled, because it positively differentiates between flame and hot brick.

This flame detector senses only the flame!

No more hot refractory hold-ins!

For the first time, you can be absolutely sure that fuel delivery will be stopped in the absence of flame. Honeywell's C7012A Ultra-Vision* Flame Detector employs an amplified ultraviolet signal to positively distinguish between an actual flame (ultraviolet rays) and a hot refractory (infrared rays.) This revolutionary new device represents a major breakthrough in scientific flame detection.

Not only is the Ultra-Vision Flame Detector compact. It also simplifies flame supervision of both single and multiple burners because, not being sensitive to a hot refractory, it can be aimed at each individual flame in the most convenient way.

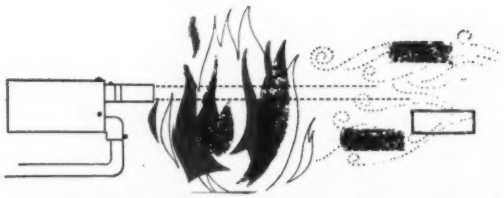
Is it economical? This amazing new flame detector will actually save you money in simplified installation and maintenance. Wiring is less expensive in this system than in a lead sulphide cell. It is easier to install because hot refractory can be ignored. And there is no further need for flame rod replacement.

For complete details, call your nearby Honeywell office. Or write Honeywell, Dept. EW12-61 Minneapolis 8, Minnesota. In Canada, write Honeywell Controls, Limited, Toronto 17, Ontario.

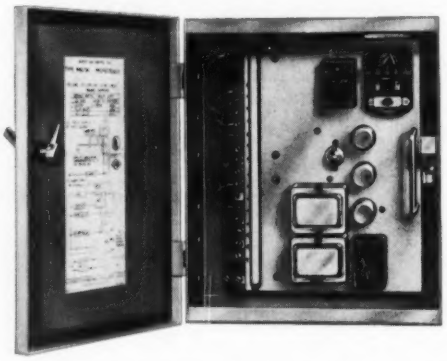
Honeywell

First in Control

SINCE 1885



Honeywell's new Ultra-Vision Flame Detector sights the flame of all fuels, but is not affected by hot brick. It does a more effective job on single burner pilot and main flame installations. And now, for the first time, multiple burner installations can also be monitored safely.



Honeywell's new R4075 Protectoglo* Flame Safeguard Relay features a "maximum-safety" self-checking circuit to continuously supervise constantly burning industrial burners. The mounting cabinet has all-voltage terminals and a quick-disconnect control base that allows this electronic flame safeguard to be completely removed without disconnecting any of the wiring.

**Trademark*

Published for 87 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Electrical World

DECEMBER 11, 1961
Vol. 156, No. 24

Dateline . . .

Missouri Basin: Tip-Off to Federal Power Role?

Washington, D. C.—The government is now in the process of outlining future power development in the Missouri Basin. How far the government goes in accepting utility responsibility there could give an indication of what it intends to do in other areas heavily dependent on government-generated power.

The nub of the Missouri Basin problem is of course the fact that the Bureau of Reclamation's main-stem Missouri River generating capacity, which is almost entirely developed, will no longer be able to meet the needs of preference customers for firm power after 1963. Looking further into the future, the probability is that the Bureau's present hydro capacity, used for firm loads, will, in the matter of a decade or two, be of use only for peaking purposes, with base load possibly to be provided by steam plants of undertermined ownership.

With this ultimate objective in mind, jockeying for position has begun with specific proposals by two co-op groups and a group of 14 utilities.

Last week, two announcements came out of Washington that are the first definite federal statements on Missouri Basin planning and that may provide a clue as to how federal policy there will be outlined:

• In a unique action, Rural Electrification Administrator Norman Clapp laid out the criteria which he feels are necessary for co-ops to qualify for loans to build a 200-Mw lignite-burning plant in North Dakota. His criteria will be almost certainly fitted soon into one application for such a plan. (EW, Dec. 4, p 67).

• At the same time, Assistant Interior Secretary Kenneth Holum named a four-man group to meet this past Friday with representatives of the 14-power company group in the eastern part of the Basin on their proposal to firm up about 650 Mw of Bureau of Reclamation hydro power for preference customers (EW, Dec. 4, p 20); Nov. 6, p 54).

The co-op proposals and the 14-company plan are outgrowths of previous attempts by two major, unwieldy pooling groups to outline future power development for the entire Basin.

The first such group was the Basin-wide "Eastern Missouri Basin Power Conference," created in 1957. This group—made up of public, investor-owned, and

(*Continued on page 5*)

Publisher Warren W Shew
Editor Charles F Hochgesang
Senior Editors Daniel T Braymer, Leonard M Olmsted, Jesse A Mock
Managing Editor Herbert R Frankel

ENGINEERING

Southeastern Editor Edward Allen, Atlanta
Midwestern Editor Francis J Kovalcik, Chicago
Western Editor Paul H Leech, San Francisco
New England Editor Howard S Knowlton, Boston
Middle Eastern Editor Bruno Zambotti
Northeastern Editor Willard L Felsen
Methods Editor Michael G McGraw
Associate Editor George Swift
Overseas Correspondent J H M Sykes, London
Consulting Editor Archer E Knowlton

NEWS

News Editor Dale VanHorn
Associate Editor Leon A Allen, Jr
Supply Lines Editor Paul F Roman
Assistant Editor William P Kennedy
Washington Correspondent N Burkey Musselman

ART & PRODUCTION

Art Director Frank C Stockman
Assistant Art Director Pressly Donald
Assistant Editor Steven Ludwig
Editorial Assistant Earl J Carter

Mfrs News Editor Michael G McGraw
Assistant Editor Elizabeth R Parker

Mgr, Mkt Research Arthur J Stegeman

Commercial Editor John D Damon

ADVERTISING

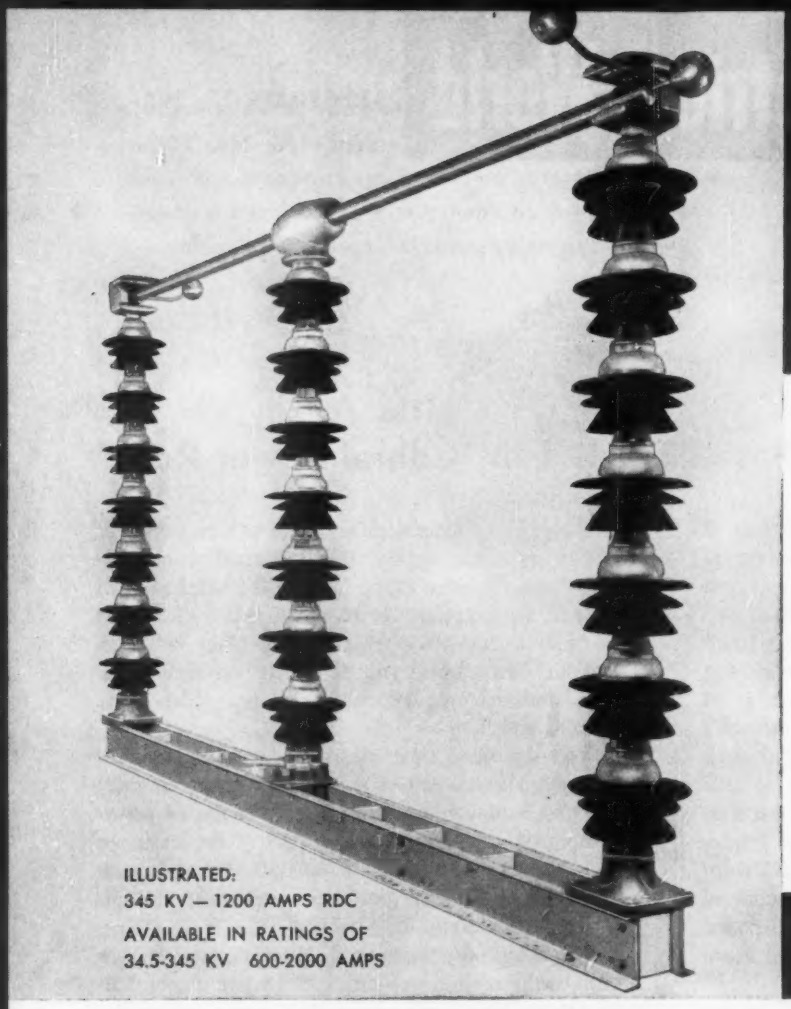
Sales Manager Walter R Klein

District Managers E B Sessions, J B Roll, Jr, New York; D L Roberts, Boston; E A Martin, Philadelphia; E F Coffey, Jr, Cleveland; E F Coffey, Jr, Detroit; M S Kearney, Pittsburgh; W H Meneilley, J T Schaefer, Chicago; J T Schaefer, St. Louis; Robert Yocom, Los Angeles; T H Carmody, John Hernan, San Francisco; Robert H Powell, Atlanta; John Grant, Dallas; D O Hanson, Houston; Carl Coash, Jr, Denver; Scott Hubbard, Portland, Ore.

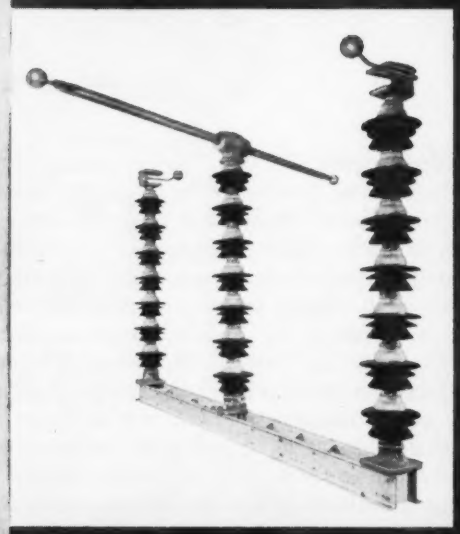
Business Manager Otto A Drechsel
Asst Business Mgr John F Dugan

Promotion Manager Donald K Ellis

Circulation Manager S A La Faso



ILLUSTRATED:
345 KV — 1200 AMPS RDC
AVAILABLE IN RATINGS OF
34.5-345 KV 600-2000 AMPS



For Appearance, Low RIV, and Ease of Operation Choose Southern States RDC Side-Break Switch

Certain design characteristics count heavily in the selection of air switches.

Appearance is important, especially where the switch is to be part of a modern substation. The RDC is streamlined. It has no exposed cranks, arms, or clevises to mar its smooth contours.

Radio Influence Voltage is a strong factor, especially where the switch is in an urban area. The RDC's corona-resistant lines result in RIV of less than 500 microvolts.

Ease of operation is always a prime consideration. The RDC, with the weight of the blade balanced on the center insulator, operates with ease in any mounting position.

Other important characteristics of the RDC, to be considered in judging an air switch, are: Amplitact® contacts to provide maximum dependability under short circuit stress . . . resistance of exposed metal parts to corrosion . . . one-piece blade balanced in all positions . . . simplified installation . . . and quality construction throughout.

For complete details, see your Southern States representative, or write us direct for Technical Bulletin 58RDC.

LIVE BETTER ELECTRICALLY

IN CANADA:
Dominion Cutout Co., Ltd., Toronto

SOUTHERN STATES
HAMPTON, GEORGIA

Dateline . . .

Washington, D. C. (*Continued from page* 3)
co-op systems, and representing nearly 7,000 Mw of available capacity—was too large to be effective. From it spun off several smaller pools and pooling plans, of which the 14-company proposal is one.

The second such group was the Mid-West Electric Consumers Assn, created in 1958 and headed then by Holum. This group pulled in all preference groups and proposed to build a huge municipal-co-op-federal system. Generating capacity would be built by co-op and municipal systems, while Reclamation would tie this together with federal transmission lines connecting with Nebraska systems and the Bonneville Power Administration.

But the Mid-West group also proved to be too large to be effective at once.

Two co-op applications were made to REA this year to build a lignite-burning plant, originally advocated by the Mid-West group as a natural first step in its plan.

- Lignite Electric Power Cooperative (three G&T co-ops working with two companies) applied first for $44 million to build the plant.
- Basin Electric Power Cooperative (ten G&T, five distribution co-ops) later applied for $145 million to build the plant, plus an added 200 Mw later.

Clapp, in announcing his four criteria last week, said neither of these applications meets all points, and hinted at a joint application by the two.

The rivalry therefore is probably between the 14-company and lignite plans, although it is not certain the two are incompatible. But firming of 650 Mw of Reclamation hydro power could obviate the need for the lignite steam plant.

It is now up to the Kennedy Administration to decide how far the federal government should go in assuring that the needs of preference customers are met. How it treats the lignite and 14-company proposals may be the tip-off.

Letters

What They Thought of "Turn-Key" Series

▶ Discussion of turn-key contracts as applied to electrical generating facilities (Management Newsletters Sept 4 and 11) engendered considerable comment. Here are excerpts from some of the letters received:

". . . you have quite fairly stated the pros and cons of this subject and I think the only thing that can be done now is to wait and see what results from all of this. To some of us it would seem that the interest in turn-key has somewhat cooled off. . . ."

Consulting engineer

". . . it will doubtless generate some sound and fury. If it does, you may find some comfort in Sydney Harris' column of Sept 1 which opens, 'It is interesting, and instructive, to see how the human animal responds to an attack on his beliefs and convictions. He does not try so much to rebut the arguments of the attacker as to impugn his motives."

Technical information director for manufacturer

". . . I cannot see utilities abdicating their position in determining the nature of the plants for their systems. A thoughtful discussion such as this is a very distinct service to the industry."

Vice president for consulting firm

". . . The subject is very well treated."

Executive vice president, manufacturer

"The hazards of misunderstanding under a turn-key contract, as to just what the owner is going to receive in an operating plant, unless there is a complete meeting of minds on a specification description before the contract price is agreed upon, is great . . ."

Utility executive

". . . After all the smoke has cleared away, the decision to use this approach and the very substantial savings are going to rest with the executives of electric companies rather than with either manufacturers or engineers."

Utility president

ELECTRICAL WORLD
Vol. 156, No. 24 December 11, 1961

Published weekly by McGraw-Hill Publishing Co., Inc., James H. McGraw (1860-1948), Founder. Executive, Editorial, Circulation and Advertising Offices: McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y.

Officers of the Publications Division: Nelson L. Bond, President; Shelton Fisher, Wallace F. Traendly, Senior Vice President; John R. Callaham, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising Sales; A. R. Venezian, Vice President and Circulation Coordinator; Daniel F. Crowley, Vice President and Controller. Officers of the Corporation: Donald C. McGraw, President; Hugh J. Kelly, Harry L. Waddell, Executive Vice Presidents; L. Keith Goodrich, Executive Vice President and Treasurer; John J. Cooke, Vice President and Secretary.

Subscriptions are solicited from executive, supervisory, and engineering personnel in electric utilities, manufacturing companies, and related fields; and from consulting engineers and electrical engineers in industry. Position and company connection must be indicated on subscription orders. ELECTRICAL WORLD is available only by paid subscription. Publisher reserves the right to refuse non-qualified subscriptions. Please send to the address shown in the box below.

United States and possessions subscription rate for individuals in the field of the publication $6.00 per year; Canada $7.00; single copies 50 cents. Other Western Hemisphere and the Philippines $20.00 payable in advance and other countries $30.00 payable in advance.

Printed in Albany, N. Y.; second-class postage paid at Albany, N. Y. Title ® registered in U. S. Patent Office. © Copyrighted 1961 by McGraw-Hill Publishing Co., Inc. Quotations on bulk reprints of articles available on request. All rights reserved, including the right to reproduce the contents of this publication either in whole or in part. Permission required to reproduce any of contents.

Unconditional guarantee: On written request from any subscriber, the publisher agrees to refund the unused portion of the subscription price if editorial service is unsatisfactory.

SUBSCRIPTION AND ADDRESS CHANGES: Send subscription correspondence and change of address to Fulfillment Manager, ELECTRICAL WORLD, 330 West 42nd Street, New York 36, N. Y. Change of address notices should be sent promptly; provide old as well as new address; include postal zone number, if any. If possible, attach address label from a recent issue. Please allow one month for change to become effective.

Postmaster . . . Please send form 3579 to Electrical World, 330 W. 42nd St., New York 36, N. Y.

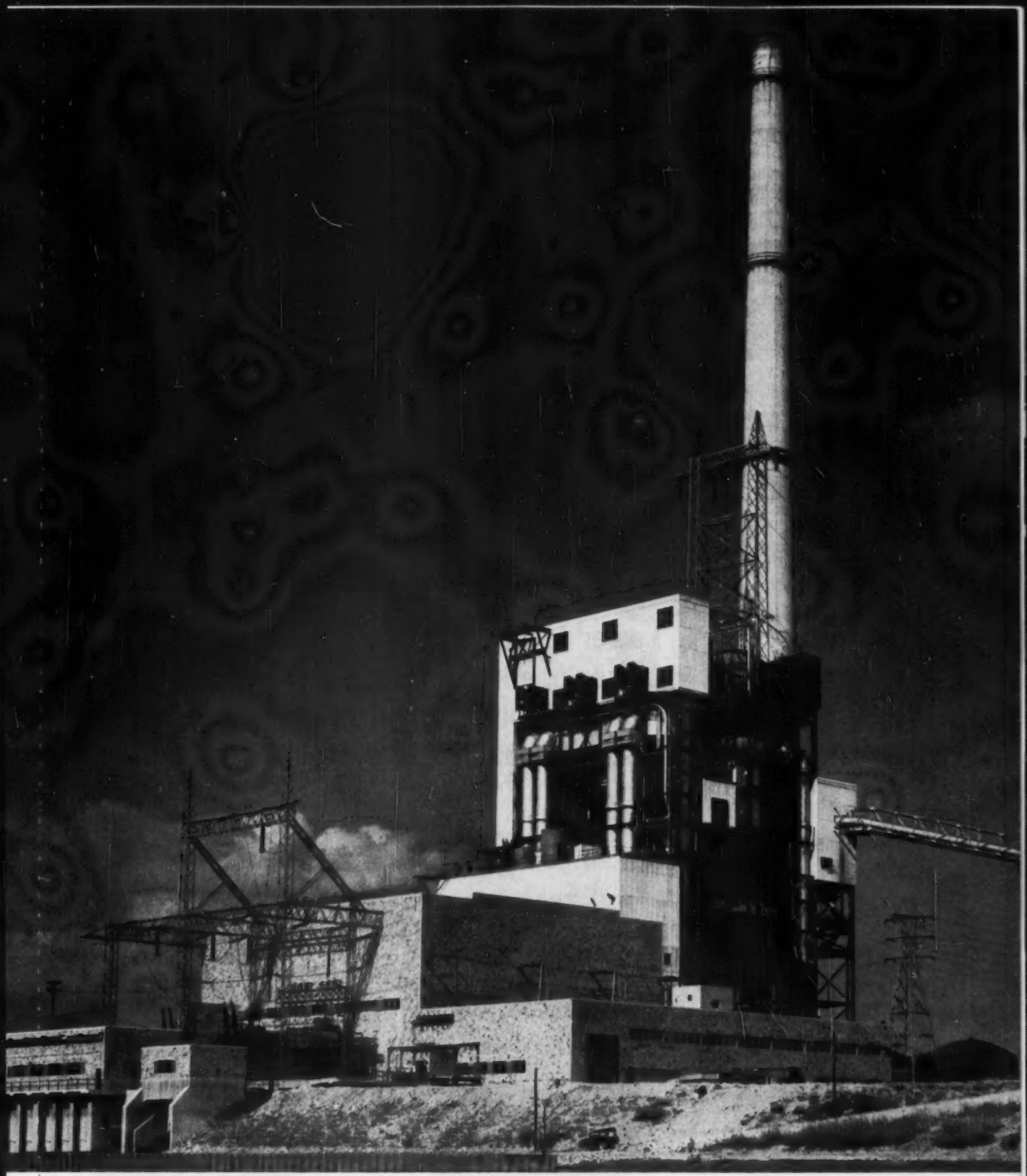
ACTUAL SIZE

Where can you burn this much coal and get a kwh?

Electric utilities are squeezing more power out of each pound of fuel because of a B&W development.

In its first five months of commercial operation, a B&W Universal Pressure® boiler system helped Breed Plant of Indiana & Michigan Electric Co. on the American Electric Power System achieve a net heat rate of 8,807 Btu per kilowatt-hour. This is significantly better than the nation's most efficient power plant (which also uses B&W boilers) according to figures recently reported by the Federal Power Commission.

The B&W Universal Pressure boiler system delivers the full



In a B&W Universal Pressure boiler system.

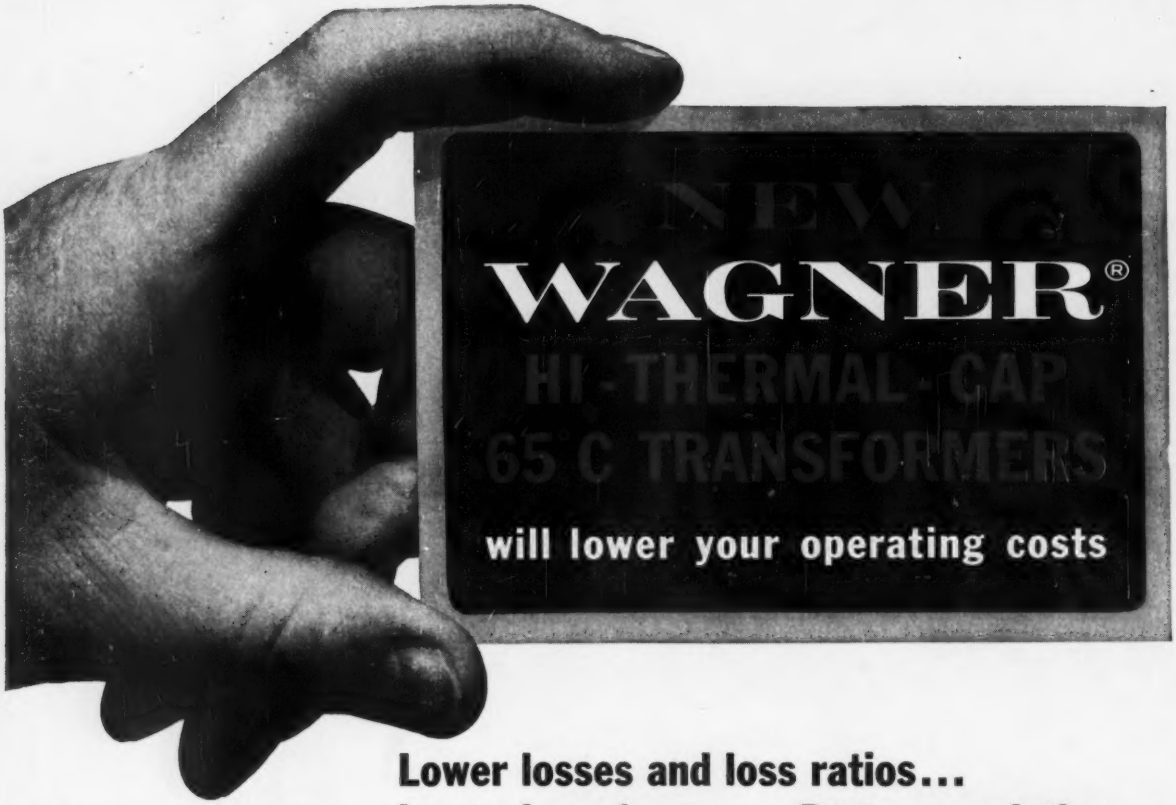
potential of high temperature, high pressure cycles. It makes most efficient use of fuel during start-up, operation, and shutdown.

The system reduces plant capital costs. Because it weighs 20% less than a drum boiler, a B&W Universal Pressure boiler system requires a smaller foundation, less building steel. Erection is faster, takes fewer manhours.

Sixteen Universal Pressure boiler systems, totalling 6,450,000 kw, are now installed or on order.

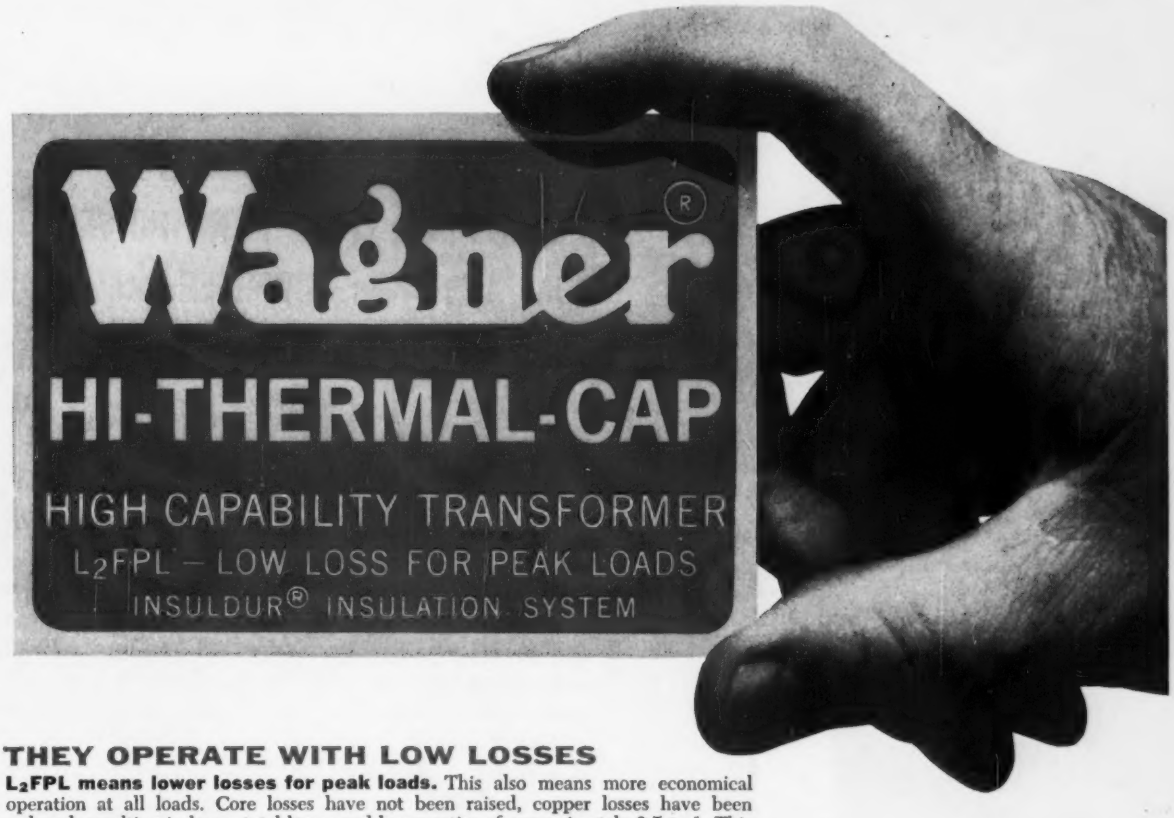
The Babcock & Wilcox Company, Boiler Division, Barberton, Ohio.

Babcock & Wilcox



Lower losses and loss ratios...
Lower impedances... Better regulation...
High capability for peak loads...
Insuldur® insulation systems

LIVE BETTER...*Electrically*



THEY OPERATE WITH LOW LOSSES

L_2FPL means lower losses for peak loads. This also means more economical operation at all loads. Core losses have not been raised, copper losses have been reduced, resulting in lower total losses and lower ratios of approximately 2.5 to 1. This provides savings in cost of losses under normal loading conditions, and on overloads. Since the cost of losses greatly affects operating expense, the lower total losses add up to lower operating costs.

These new Wagner Transformers will help you meet tomorrow's loads and their requirements reliably and economically.

HANDLE PEAK LOADS WITH EASE

INSULDUR® Insulation System allows high thermal loading with 65°C rise transformers. The high thermal capabilities of Wagner® HI-THERMAL-CAP 65°C Transformers result from the use of Insuldur layer insulation and high temperature epoxy coated conductors. The remarkable thermal aging characteristics of Insuldur cuts insulation failure due to heat in half. Insulation retains full dielectric strength and binding qualities at 65°C operation.

MAINTAIN GOOD CUSTOMER VOLTAGE

Lower impedances improve voltage regulation. Impedances for ratings 100 Kva and below are 2% or less. You get minimum voltage drops even under high overloads – regulation problems are minimized.

Coils are wound with thermosetting resin on the layer insulation which bonds the coils together. The new endplate design gives positive bracing. This assures high short circuit strength of at least 40 times full-load current.

ARE SMALLER AND LIGHTER

Allow you to increase capacity without additional investment in new poles. The new Wagner HI-THERMAL-CAP 65°C, 25 Kva, 7200 volt Transformers are lighter and smaller – 2½" shorter than their 55°C counterparts, yet use approximately the same amount of oil. They are easier to store and handle – take less space on poles. For example, a 55° 100 Kva transformer can be replaced with a 65° 167 Kva transformer.

PLUS ALL THE FEATURES YOU WANT . . .

SIMPLIFIED ENDPLATE DESIGN • PLASTIC-COATED COVER • NEW LV BUSHING ASSEMBLY • HV BUSHING DESIGNED FOR SAFE INSTALLATION • HIGH TEMPERATURE INSULATING OIL • LONG-LASTING SURE-SEAL PAINT • ROLLED UNDER BASE DESIGN

For additional information on this new dollar-saving line of Wagner HI-THERMAL-CAP 65° C Transformers, ask your nearby Wagner Sales Engineer, or write us.

Wagner Electric Corporation
6456 PLYMOUTH AVENUE, ST. LOUIS 33, MO., U.S.A.
Manufacturers of LOCKHEED® Products

WT61-19

R. A. KEPPLE, WEST PENN POWER COMPANY, WINS COMMERCIAL GOLD MEDAL POWER-UP AWARD

St. Vincent's College in Latrobe, Pa., faced a particularly tough water heating problem in 1960. R. A. Kepple, Commercial Representative for West Penn Power Company, solved it electrically. His unique approach requiring no increase in billing demand was judged the 1961 Gold Medal Power-Up Achievement Award winner in the Commercial Category.

The problem appeared to be simple. Hot water supply from the old tanks fell short of demand. Water was frequently rusty. The steam heating line was noisy and troublesome. When the old tanks sprang serious leaks in 1960, the situation became critical.

From a functional standpoint, electric water heating was the perfect solution. But to be economical, existing billing demand could not be increased. Simply heating during "off-peak" hours and storing hot water for use during "on-peak" required too-expensive storage facilities.

Mr. Kepple marshalled the full cooperation of St. Vincent's, West Penn Power and equipment suppliers. His solution, now in successful operation, employs a battery of strategically located electric water heaters. During "off-peaks" their operation is controlled by thermostat. Through use of a unique relaying system, they may also operate during "valleys" in the "on-peak" period.

St. Vincent's is delighted. The new system is safe, flexible and economical. Hot water is good and plentiful. More heaters are on order. West Penn has a happy customer with a better load factor and increased load.

Bronze Medal Power-Up Award winners in the Commercial Category are Jacob M. Gensburger, New Orleans Public Service, Inc.; Gerald A. Mattern, West Penn Power Company; and Raymond B. Faulkner, The United Illuminating Company.

E. C. LAWHORN, TEXAS POWER & LIGHT COMPANY, WINS INDUSTRIAL GOLD MEDAL POWER-UP AWARD

A fifteen-year search for ways and means to halt rising pumping costs in the Van Oil Field, Van Zandt County, Texas, was ended in 1961. The solution, recommended by Mr. E. C. Lawhorn, Power Consultant, Texas Power & Light Company, has earned him the 1961 Gold Medal Power-Up Achievement Award in the Industrial Category.

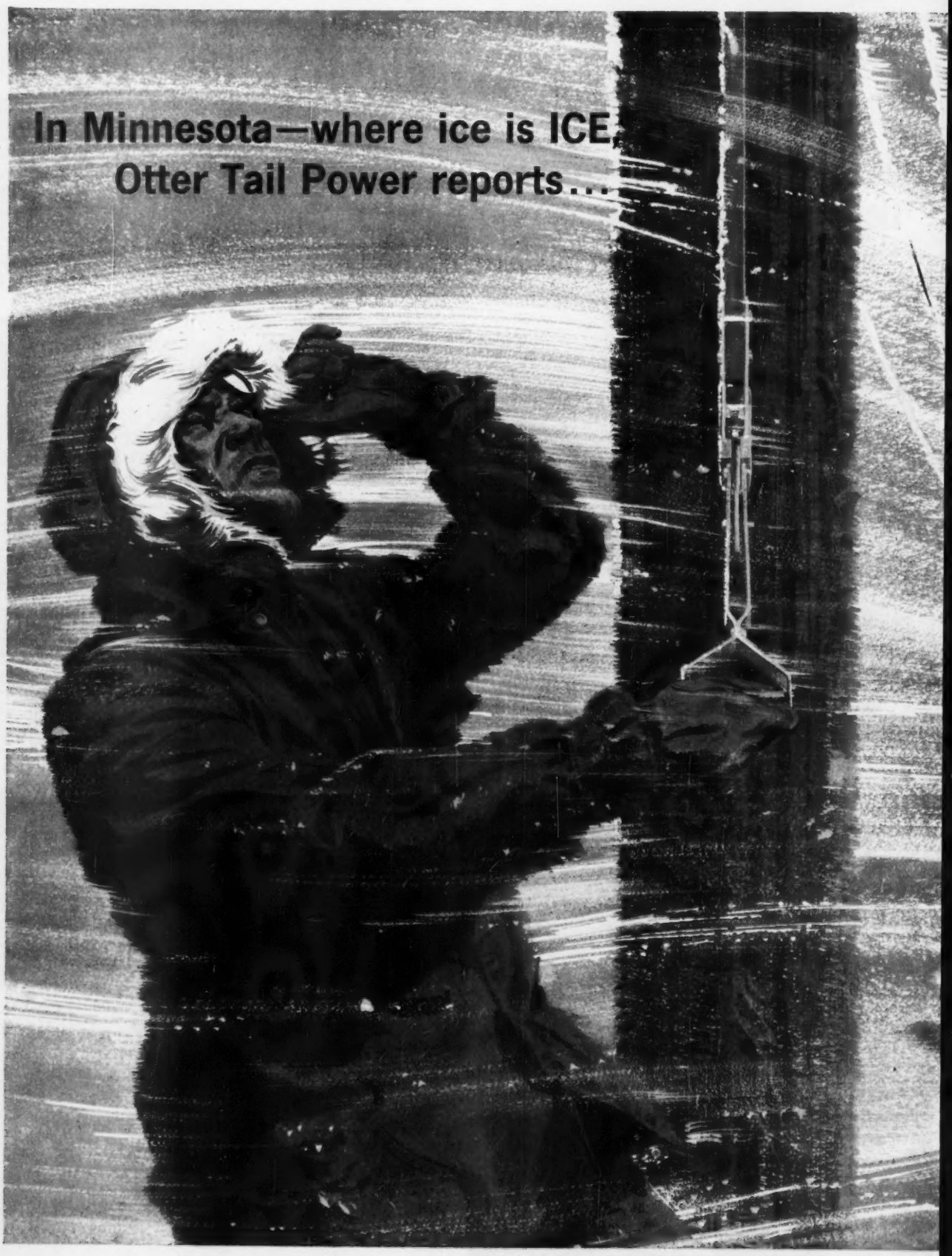
The problem centered on the use of natural gas engines for pumping operations. Operating costs, based on no-longer-valid circumstances, were going up. Maintenance and down-time were up. These factors were causing some potentially profitable wells to be considered marginal.

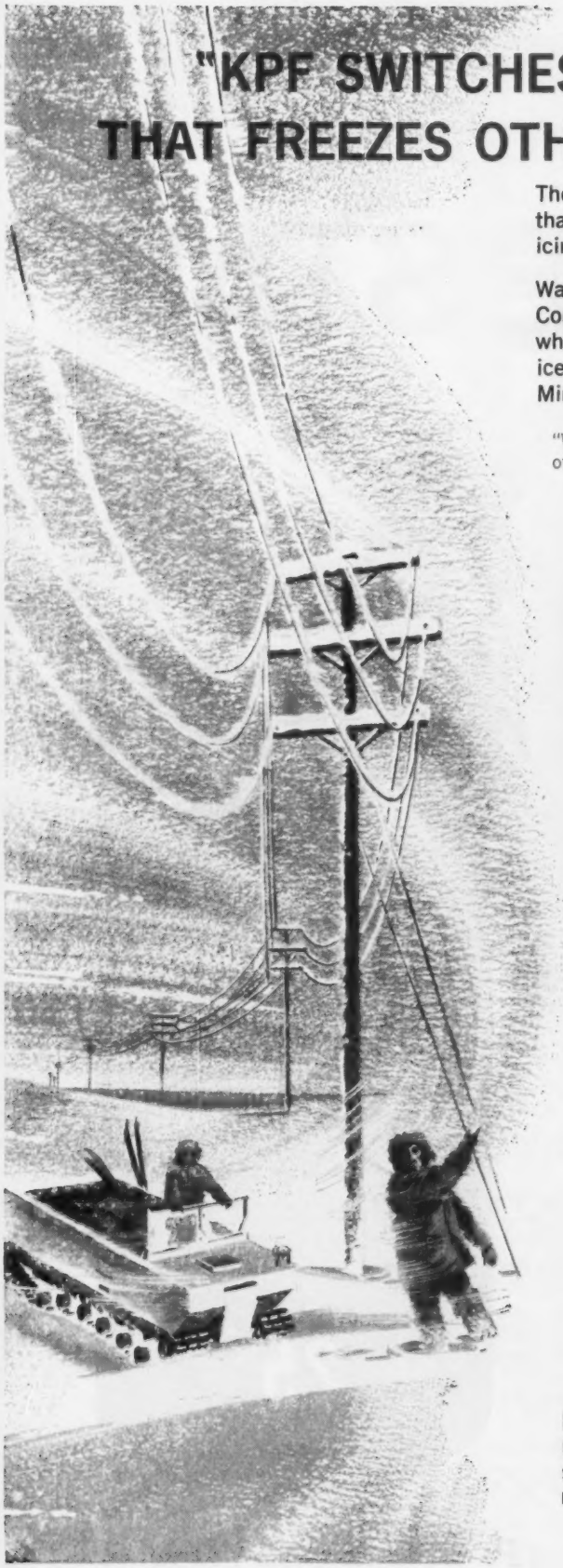
Mr. Lawhorn, working with the operating oil companies, T. P. & L. and an outside corporation to finance and lease the distribution system, proposed the installation of modern pumping equipment equipped with electric motors and automatic controls. Now in operation, this equipment has enabled the operators to use labor more efficiently, reduce maintenance time and expense and return some marginal wells to production. In additions, the new pumping units are far safer and less noisy in operation. Finally, Texas Power & Light gained a sizeable and growing load over a long term period.

Bronze Medal Power-Up Award winners in the Industrial Category are Paul R. Stewart, Pennsylvania Power and Light Company; Cornelius Ackerman, Public Service Electric and Gas Company; and Frank E. Yanaros, Florida Power and Light Company. The efforts of these men are shining examples of how the nation's electric utility power sales engineers help make electricity a more useful and widespread servant throughout commerce and industry. Westinghouse is proud to sponsor the Power-Up Program. *You can be sure . . . if it's Westinghouse.*

J-07501

Westinghouse


In Minnesota—where ice is ICE,
Otter Tail Power reports...



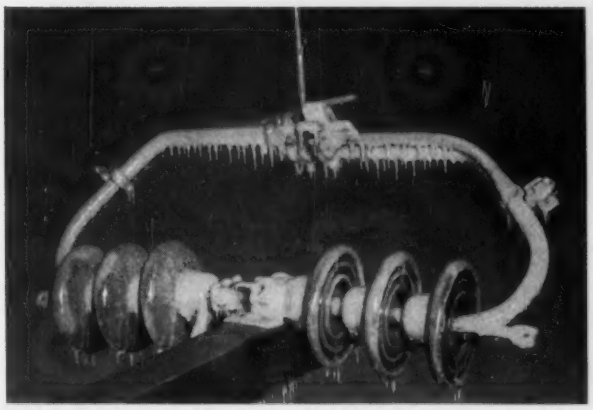
"KPF SWITCHES OPERATE UNDER ICE THAT FREEZES OTHER SWITCHES SOLID!"

The hard clear ice of northwestern winters — and the silver thaws of Texas — probably provide utility men with as much icing trouble as any set of conditions in the United States.

Warren Nye, Vice President, Electrical, of Otter Tail Power Company, has had his share of 80 mile per hour winter winds, whipping iced lines, and poles and switches sheathed in pure ice. Writing from his Company's headquarters at Fergus Falls, Minnesota, Mr. Nye says succinctly,

"We have found KPF switches easier to operate under conditions of ice than any other switch we have ever used."

HOW KPF SWITCHES CRACK OFF ICE



The mechanism of KPF switches is big, simple and rugged. There are no complex, finnicky doodads to freeze, bind or need lubrication.

A simple, positive-action control rod moves an interphase rod which rotates the blade arms of KPF phase units.

Blades and stationary clip holders are flexible so the moving arms can, literally, be "rocked" or "wobbled" by one man at the operating lever below.

The force exerted at the switchblade-clip holder position is many times that required to crack off the thickest natural ice.

The only time KPF switches have been not immediately operable under ice was when the entire pole and control rod assembly itself was sheathed in ice. It was necessary to clear ice to reach the operating lever and effect the "cracking off" process.

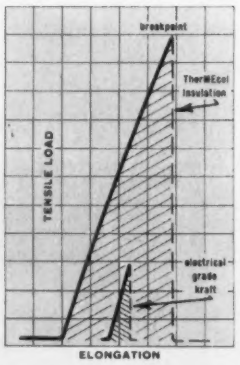
Install a KPF unit in your most demanding location - and watch its dependable, easy operation

6380

KPF ELECTRIC CO.
P.O. Box 1257E
Stockton, California
HOward 4-8381 • Area Code 209

KPF
AIR BREAK SWITCHES
Standard for half a century

New POLE STAR



above left: Herbert W. Dornbush, Pennsylvania Transformer's chief distribution engineer, compares the new Pole Star 65 Transformer with its larger, heavier predecessor. The newly designed unit eliminates cooling tubes through 50 kva.

above right: An important area of TherMEcel Insulation's superiority over ordinary kraft insulation is shown by this comparison of toughness, which embodies both tensile strength and stretch. Toughness is indicated by the shaded areas.

Developed in Edison Laboratory... TherMEcel Insulation Takes High Temperatures with Little Effect on Electrical, Mechanical Strength

New TherMEcel Insulation was developed for Pennsylvania's new Pole Star 65 Transformer as a joint, long-range project of the Thomas A. Edison Research Laboratory. Accelerated life tests have proved that TherMEcel Insulation—specially treated kraft paper with high mechanical and electrical strength—possesses exceptional retention ability of all necessary characteristics when subjected to high temperatures for extended periods. Characteristics studied included toughness, fold endurance, burst and tensile strength, tear resistance, and dielectric strength. Optimum results are assured because TherMEcel Insulation imposes no restrictions on transformer winding designs.

Facts and figures tell the story of smaller, more efficient POLE STAR 65 TRANSFORMERS

Example: Conventional Type, 7200-120/240 volts

	10 KVA			25 KVA			50 KVA		
	New* PS @85C	Former† PS @75C	% Reduction	New* PS @85C	Former† PS @75C	% Reduction	New* PS @85C	Former† PS @75C	% Reduction
Core Loss (Watts)	67	67	0	118	129	8.5	190	217	12
Total Loss (Watts)	208	248	16	446	505	11.5	719	883	18.5
Impedance (Percent)	1.7	2.3	26	1.9	2.2	13.5	1.8	2.1	14
Regulation (Percent) (80% P.F.)	1.7	2.4	29	1.9	2.2	13.5	1.8	2.1	14
Total Weight (lbs.)	254	254	0	448	474	5.5	708	803	11.5

*Pole Star 65 Transformer rated 65C rise. †Pole Star Transformer rated 55C rise.

PENNSYLVANIA POLE STAR

65 TRANSFORMER

With Edison Laboratory-developed TherMEcel Insulation plus

Large terminal openings, to accommodate both copper and aluminum conductors

Skyblue Covers to protect against animal-caused outages

Internal bushing clamps and cover bands—eliminating potential dirt catchers

Lap-on-top Pole Star Core, more efficient than ever in new 65C-rise unit

lets you load with confidence of high usability

- low losses at all loads
- less voltage drop
- more power per pole

To be properly evaluated, load-ability of a distribution transformer should be judged in terms of *usability*—the degree to which the capacity of the transformer can be utilized without sacrificing economy and quality of service.

The new Pole Star 65 Transformer was designed to satisfy these operating requirements. Smaller and up to 12% lighter than its predecessor, the new Pole Star Transformer stretches the kva capacity of your poles . . . then lets you load with *confidence* of results such as:

Loading a 10-kva, 7200-volt unit to 20 kva with no decrease in life expectancy. Compared with the previous design, loss is 20% less, and voltage drop is reduced by 29% to only 3.4%. The new 10-kva Pole Star can be loaded to 142% before voltage drop equals that of its predecessor at 100% load.

Thus, operating costs are low . . . higher loading is possible without exceeding secondary voltage limits . . . and costly changeouts can be postponed far beyond former transformer loading schedules.

TherMEcel-Insulated Winding Combined with Pole Star Core

Such outstanding efficiency is made possible by an increase in winding-temperature rise to 65C, thanks to the remarkable heat stability and other characteristics of TherMEcel Insulation. Developed as a long-range project in cooperation with the Thomas A. Edison Research Laboratory, TherMEcel Insulation possesses exceptional retention ability of its high mechanical and electrical strength when subjected to high temperatures for extended periods. In the Pole Star 65 Transformer, TherMEcel Insulation is utilized to fullest advantage in a compact winding combined with the service-proved Pole Star "echelon" lap-on-top core.

* * *

Commercial production of new designs will start early in 1962. For further information about the Pole Star 65 Transformer and TherMEcel Insulation, contact the Distribution Department, Pennsylvania Transformer Division, McGraw-Edison Company, Box 330, Canonsburg, Pennsylvania.

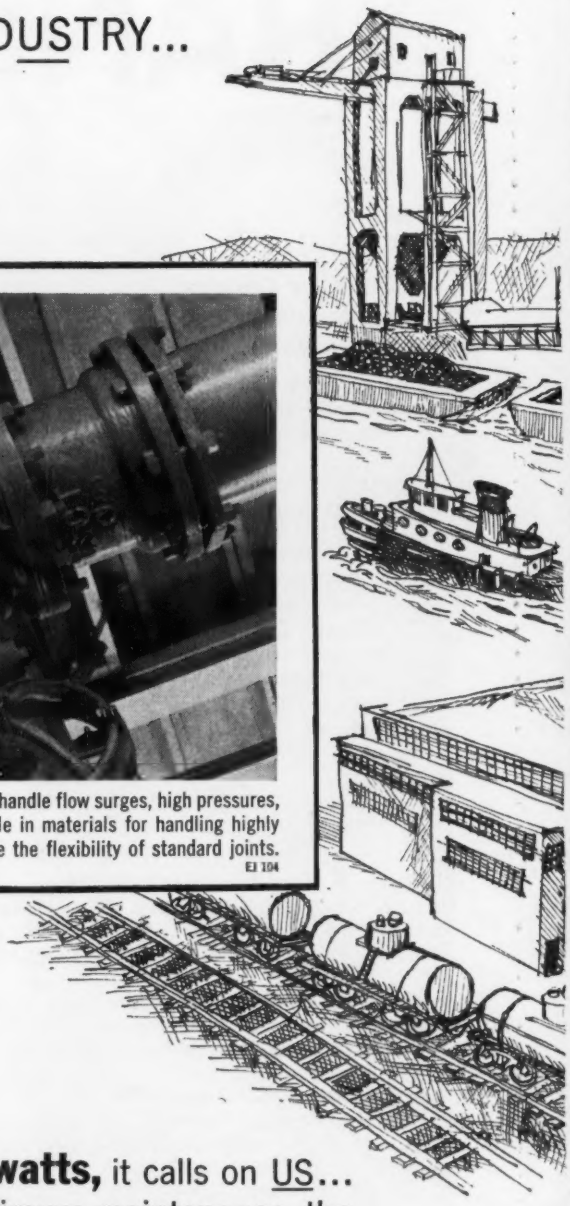
McGRAW EDISON

DISTRIBUTION TRANSFORMERS

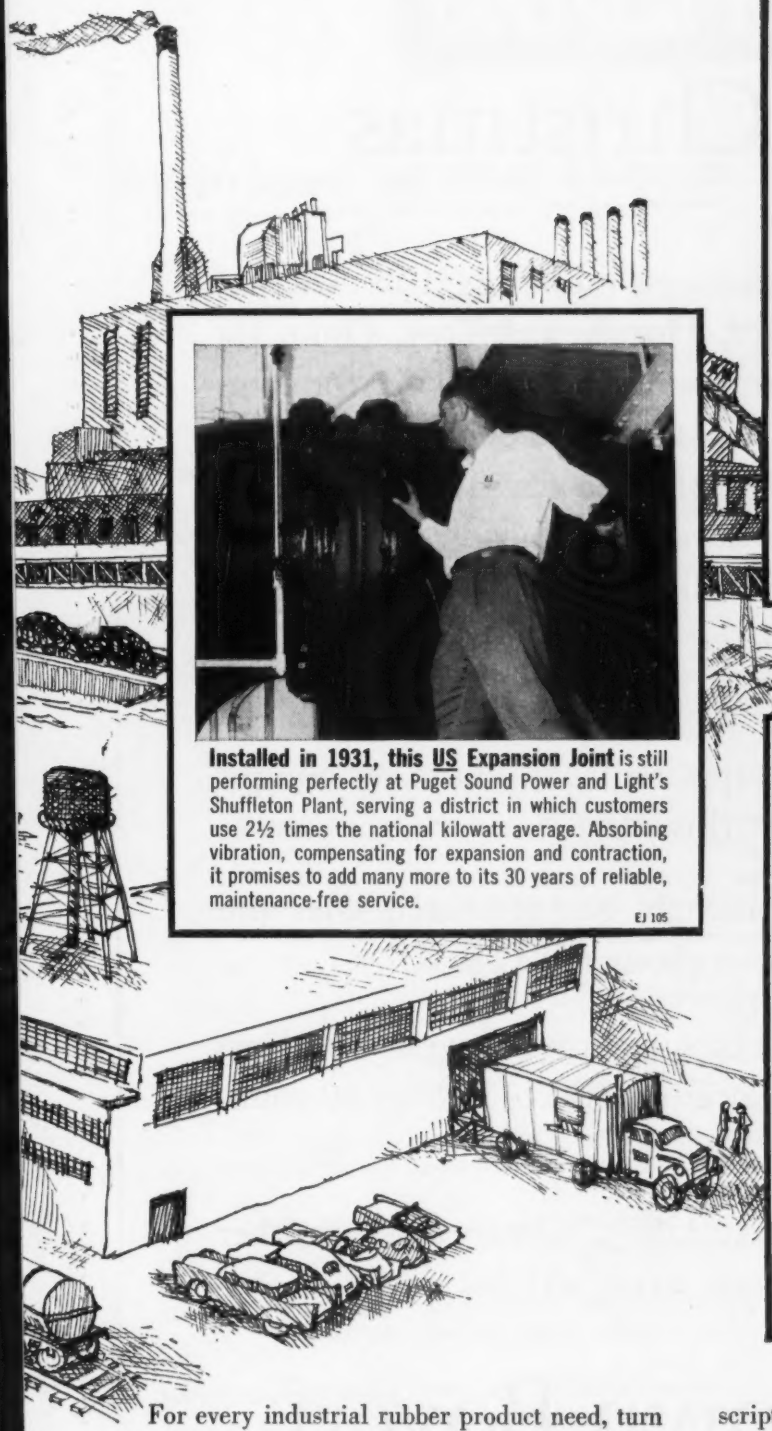
US AT THE HEART OF INDUSTRY...

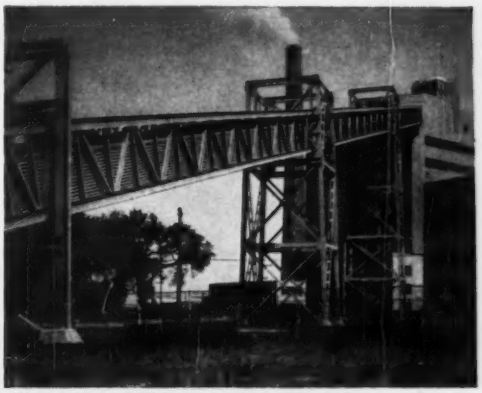
Designed to meet today's most rigid requirements, U. S. AMR Expansion Joints handle flow surges, high pressures, and high temperatures unheard of a few years ago. AMR Expansion Joints are available in materials for handling highly corrosive chemicals, wide temperature ranges, and, despite their high strength, have the flexibility of standard joints.

EJ 104



When industry converts coal into kilowatts, it calls on US... for industrial rubber products that provide minimum maintenance, the utmost in reliability and profit. As the world's largest producer of industrial rubber products, US supplies the needs of utilities everywhere.



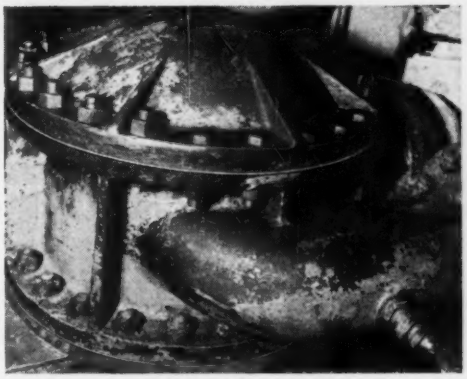


Busy moving 600 tons of coal per hour at Toledo Edison's ultra-modern Bayshore plant, a US Conveyor Belt system has performed day in and day out with unfailing dependability, and at impressively low operating temperatures. The system uses 5 U.S. Matchless® Belts, was constructed by US engineers so that its capacity can be doubled whenever desired.

CB 130

Installed in 1931, this US Expansion Joint is still performing perfectly at Puget Sound Power and Light's Shuffleton Plant, serving a district in which customers use 2½ times the national kilowatt average. Absorbing vibration, compensating for expansion and contraction, it promises to add many more to its 30 years of reliable, maintenance-free service.

EJ 105



Most recommended for superheated and saturated steam at temperatures to 750°F., US asbestos-base Style 899 Sheet Packing also gives superior service with ammonia, gases, oils, gasoline, some acids, alkaline solutions, and other chemicals. Made of specially selected long-fiber asbestos, Style 899 Sheet Packing won't soften, burn or blow at joints and flanges.

P 103

For every industrial rubber product need, turn to US. For Conveyor Belts, V-Belts, the original PowerGrip "Timing"® Belt, Flexible Couplings, Mountings, Fenders, Hose and Packings . . . custom-designed rubber products of every description. Discover why U.S. Rubber has become the largest developer and producer of industrial rubber products in the world. See your U.S. Rubber Distributor or contact US directly at Rockefeller Center, New York 20, N. Y.

WORLD'S LARGEST MANUFACTURER
OF INDUSTRIAL RUBBER PRODUCTS

United States Rubber

MECHANICAL GOODS DIVISION

Merry Christmas

To all our 1961 customers, including the cities of Los Angeles; Fort Pierce, Florida; and Troy, Ohio, for turbine generators ☞ American Electric Power for communications equipment ☞ Outboard Marine Corp. and The Budd Company for electric furnaces ☞ Arizona Public Service for transformers ☞ Alabama Electric Cooperative for airblast circuit breakers ☞ and the many other U.S. companies, large and small, with whom we are pleased to do business.

To the scores of U.S. suppliers from whom we bought materials and equipment this year.

To the men and women in our affiliated sales and service organizations throughout the U.S.

To our 73,000 co-workers in Brown Boveri's 40 plants and in our sales and engineering offices in over 80 countries of the Free World.

To G.E., Westinghouse, Allis-Chalmers and our other competitors for adding zest to our efforts.

from Brown Boveri

Full-line manufacturer of electrical and mechanical power equipment for industry and utilities. Brown Boveri Corporation, 19 Rector Street, New York 6, New York

Electrical World

DECEMBER 11, 1961
Vol. 156, No. 24

Preview of the Issue

DEPARTMENTS

Editorial Comment 49
Dateline 3
Letters 5
Electrical Week 20
Supply Lines 21
News Scope 51
Todays Design Trends... 56
EUM 76
Manufacturers News 80
New Equipment..... 88
Management Newsletter.. 97
Selling 105
News About People.....108
Advertising Index.....112

● **THERE'S A HEAVY EMPHASIS ON INTERCONNECTIONS in current power news, and much of it is due to federal plans and proposals. Behind the economic and technical aspects of proposed federal interconnections are hard political issues and fundamental issues of national policy. A 16-page special report goes deeply into the Washington scene to determine where the Administration is headed** **57**

● **ELECTRIC HEATING IS THE HEART OF THE TOTAL ELECTRIC HOME, and the 1962 Live Better Electrically Program will stress this. It aims to surpass the estimated 5.2 million electrically heated homes expected in 1970** **105**

CURRENT EVENTS

TWELVE ANTITRUST DAMAGE SUITS are filed in New York by 44 utilities; 21 electrical manufacturers are named as defendants 50

FLORIDA OPERATING COMMITTEE is formed by four of state's utilities; joint planning, unit scheduling is in the works 52

A 345-KV INTERCONNECTION between American Electric Power System and Illinois Power Co will go in service in 1963 53

OXBOW DAM, Idaho Power's second step in developing the Snake, goes on line 112

DATELINE

FEDERAL PLANS FOR THE MISSOURI BASIN, expected soon, may provide a clue as to what the government has in store for other areas as well 3

ELECTRIC UTILITY METHODS

TOWER WORK IS EASED by using working platform . . . Cranes speed setting of dead-end tower sections 76

ENGINEERING

UTILITIES ARE RESPONDING to surge of interest in underground distribution, but standardization is needed to keep costs down 54

MANAGEMENT NEWSLETTER

AN OUTSIDER'S VIEW of the antitrust laws is presented by Leland Hazard, who asks, "Are Our Antitrust Attitudes Valid?" 97

MANUFACTURERS NEWS

TWICE THE CAPACITY PER POUND is claimed for new mobile transformers . . . Huge stator yoke for vertical synchronous generator is machined 80

SUPPLY LINES

FPC REPORTS ON UTILITY FUEL CONSUMPTION in September and year to date . . . Purchasing men view fourth quarter business trend with reserved optimism 21

TODAYS DESIGN TRENDS

EPOXY HOOK LADDER is now used as standard equipment by Philadelphia Electric Co for transmission tower work 56

NEXT WEEK

AN EUM SPECIAL REPORT shows what's the latest in the how-to-do-it field.

The Electrical Week

FUTURE NEWS ▶ **The 100-page report on the proposed Bonneville-California intertie** will be released by Interior Secretary Udall's special task force this coming weekend. The report will go into economic and engineering details, and, while it will definitely recommend that a connection be built, it will leave this recommendation flexible enough to fit most of the "ifs" surrounding the line: **(1)** size and location, **(2)** ownership—federal, public or private, **(3)** availability of power to be moved over line, plus market potential.

LATE NEWS ▶ **Consumers Power Co files 10 triple-damage suits** against 22 manufacturers of electrical equipment. Damages sought are not specified. Earlier last week, a group of 44 northeast utilities filed 12 similar suits (see p 50).

Out-of-court settlement of damage suits is still hoped for by General Electric Chairman Ralph Cordiner. Cordiner tells year-end press conference that if there is good will on both sides, there is reason to believe an equitable agreement can be reached. At the same time, the company announces that former President Charles E. Wilson has completed his assignment of handling voluntary studies with customers (EW, Feb. 27, p 15) and that a new Antitrust Settlement and Litigation Operation has been created by the company.

Switching error during commissioning of new generating unit causes a short circuit on 132-kv network in southeastern England, cutting about half the power supply to the area for up to two hours during the afternoon of Dec. 3. CEGB apologies for the outage, explains, "We employ human beings."

Consolidated Edison moves in cots at critical points in preparation for a possible strike. Union members are mailing in new ballots after union head calls off earlier strike plan.

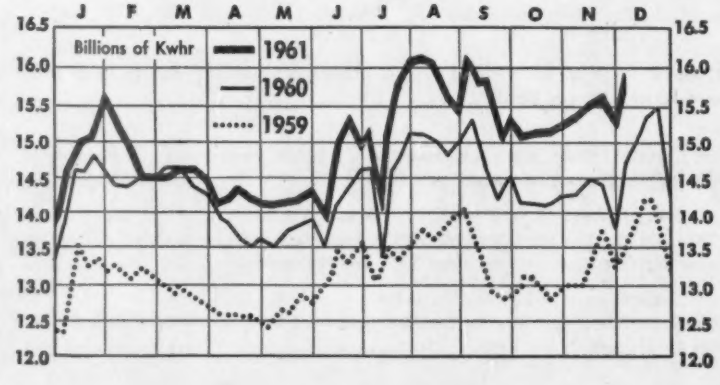
Treasury Department singles out electrical equipment manufacturing industry as one of six industries to be studied within next two months in preparation for Administration moves allowing faster tax write-offs for capital equipment (EW, Oct. 30, p 53). Five other industries are: railroads, aircraft and parts, metal working machinery, machine tools, and steel mills.

Corps of Engineers awards $15.5 million contract to Baldwin-Lima-Hamilton for 13 hydro turbines for John Day and Lower Monumental Dams (EW, Dec. 4, p 21).

C. C. Ernst, president of California Electric Power Co, dies in New York Dec. 5.

WEEKLY POWER OUTPUT—Up 8.0%

(Week ending Dec. 2), Kwhr 15,954,000,000



Percent Change From Previous Year

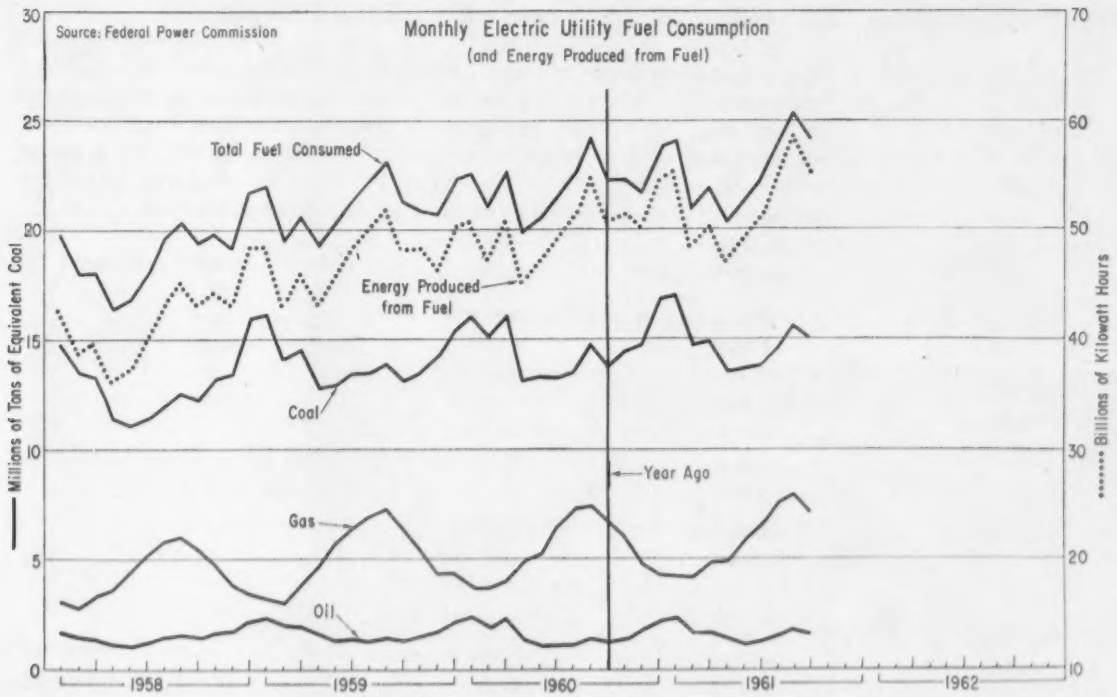
	Nov. 18	Nov. 25	Dec. 2
Total U. S.	+ 8.6	+10.4	+ 8.0
New Eng.	+10.6	+12.0	+ 9.1
Mid. Atlan.	+10.2	+11.5	+ 9.7
Cent. Indust.	+ 8.5	+10.0	+ 8.0
West Cent.	+ 9.4	+11.9	+ 6.9
Southeast	+ 4.2	+ 9.1	+ 5.2
South Cent.	+ 8.4	+ 8.9	+10.2
Rocky Mount.	+13.6	+11.5	+ 9.4
Pacific			
NW	+ 7.7	+ 8.2	+ 5.7
SW	+15.2	+14.4	+12.1

Seasonally Adjusted Index 300

Week Ago 302 Year Ago 278

Source: Edison Electric Institute

Supply Lines



FPC REPORTS ON UTILITY FUEL CONSUMPTION IN SEPTEMBER AND 1961

The Federal Power Commission reports that consumption of fuel by electric utilities for the 12-month period ended September 30 totaled 179.8 million tons of coal, 1,793.6 billion cu ft of gas, and 85.7 million barrels of oil. These amounts represent increases of 3.6% for coal, 5.8% for gas, and 0.2% for oil, as compared with corresponding totals in 1960.

Coal stocks on hand at power plants October 1 totaled 50.9 million tons, 3.4% below last year. Based on the September rate of consumption, coal stocks were sufficient to last 102 days as compared with 114 days a year before. Fuel oil stocks on hand October 1 totaled 21.8 million barrels compared with 18.3 million barrels in 1960. Based on September use, stocks were sufficient for 102 days' requirements as compared with 93 days a year earlier.

	September	Year Ago	% Change	Cumulative Through September This Year	Last Year	% Change
Coal (million tons)	15.01	13.89	+8.1	133.44	130.15	+2.5
Oil (million barrels)	6.43	5.90	+9.0	62.07	61.60	+0.8
Gas (billion cu ft)	183.49	177.48	+3.4	1,393.08	1,323.35	+5.3
Total Fuel Consumption (million equivalent coal tons)	23.99	22.43	+6.9	204.44	198.07	+3.2
Total Fuel Generation (billion kwhr)	55.37	51.14	+8.3	472.85	450.00	+5.1

WEAKNESSES STEAL "ZIP" FROM UPWARD BUSINESS TREND, PA's REPORT

The expected—or hoped for—good fourth quarter for business is now looked at with reserved optimism by the Business Survey Committee of the National Assn of Purchasing Agents. New orders and production figures from industries reporting show a majority moving from the "better" column in October to the "same" column in November. Encouragingly, however, those reporting new orders "better" outnumber those reporting "worse" by 3 to 1. Here is the table:

New Orders	Better	Same	Worse
November	35	52	13
October	51	36	13
Production	**Better**	**Same**	**Worse**
November	31	50	19
October	51	35	14

The committee says upward pressures on prices persist, but to a lesser degree than reported in October. Report is: no change, 74%; higher, 16%; lower, 10%. In October, 19% reported higher prices.

GE ANNOUNCES NEW PRICE CHANGE—EXPLAINS TWO OTHERS

Effective November 21, General Electric's capacitor dept. lowered the price for 100 kvar capacitors from $194.66 to $187.70, and equipments with 100 kvar units were reduced accordingly. Effective November 27, published prices for low-voltage power capacitor units and equipments rated 600 v and less were increased 3%.

In explaining a previous price change on 37.5 and 75-kva distribution transformers (reduced 3% November 27), GE says the reductions were made to meet competition "two months after other manufacturers lowered their prices. During this time an analysis of the effect on our business was made . . . This action may slow down the trend toward preferred kva ratings."

And in reference to price increase ranging from 4 to 8% on mobile transformers and substations, GE says the "new published data is also intended to simplify price determination. It requires that only the incoming voltage and kva capacity need be known in order to determine equipment prices. The new approach eliminates the necessity for predetermining insulation level and temperature rise."

EARNINGS OUTLOOK GOOD, SAYS BABCOCK & WILCOX

Babcock & Wilcox Co expects to establish a new high in annual earnings in 1961, according to M. Nielsen, president. He told the New York Society of Security Analysts that 1961 earnings "will be satisfactorily higher than last year" to set the new record. Earlier the same day the company declared an increase in its quarterly dividend from 35¢ per share to 40¢.

Nielsen reported that B&W profit margins have been improving the past three years, ". . . because of concentration on ways to improve operating efficiency, supplemented by the effect of completed expenditures for capital improvement." B&W has invested about $100 million in capital improvements during the past ten years.

L-M

Here's L-M's Full Line

Sectionalizers

- Ⓐ Type GH
- Ⓑ Type GN3

Oil Switches

- Ⓒ Type VLM
- Ⓓ Type VLH
- Ⓔ Type VH
- Ⓕ Type VM
- Ⓖ Type VR
- Ⓗ Type VLR
- Ⓘ Type VCR
- Ⓙ Type NVC
- Ⓚ Type NMC
- Ⓛ Type N
- Ⓜ Type NR

Reclosers

- Ⓝ Type 4H
- Ⓞ Type E
- Ⓟ Type 3H
- Ⓠ Type R
- Ⓡ Type RE
- Ⓢ Type W
- Ⓣ Type WE
- Ⓤ Type 6H
- Ⓥ Type D
- Ⓦ Type L
- Ⓧ Type H
- Ⓨ Type S Control

Line Material's impressive array of switchgear means low-cost protection and switching for your entire system. Each device represents a contribution by Line Material, offering you the specific equipment your system requires.

Your L-M Field Engineer is anxious to show you how Line Material's complete switchgear line can provide overall system cost savings for your company.

Announces The New TYPE D

Power Class III Single-Phase Recloser

Type D—another cost-saving addition to L-M's complete recloser line from L-M Research and Development.

Blaine Schultz, Manager of Engineering, Kyle Products, presents the new L-M Type D Single-Phase automatic oil circuit recloser. This is the latest product of L-M's continuing program of providing electric utilities with overall, low-cost system protection. Type D Power Class III reclosers provide protection against faults up to 12000 amperes.

LINE MA

McGRAW

Reclosers, Sectionali

L-M

Here's L-M's Full Line

Sectionalizers

- Ⓐ Type GH
- Ⓑ Type GN3

Oil Switches

- Ⓒ Type VLM
- Ⓓ Type VLH
- Ⓔ Type VH
- Ⓕ Type VM
- Ⓖ Type VR
- Ⓗ Type VLR
- Ⓘ Type VCR
- Ⓙ Type NVC
- Ⓚ Type NMC
- Ⓛ Type N
- Ⓜ Type NR

Reclosers

- Ⓝ Type 4H
- Ⓞ Type E
- Ⓟ Type 3H
- Ⓠ Type R
- Ⓡ Type RE
- Ⓢ Type W
- Ⓣ Type WE
- Ⓤ Type 6H
- Ⓥ Type D
- Ⓦ Type L
- Ⓧ Type H
- Ⓨ Type S Control

Line Material's impressive array of switchgear means low-cost protection and switching for your entire system. Each device represents a contribution by Line Material, offering you the specific equipment your system requires.

Your L-M Field Engineer is anxious to show you how Line Material's complete switchgear line can provide overall system cost savings for your company.

LINE MATERIAL® Industries

McGRAW-EDISON COMPANY

Reclosers, Sectionalizers, and Oil Switches

McGRAW EDISON

DISTRIBUTION TRANSFORMERS · RECLOSERS, S
FUSE CUTOUTS AND FUSE LINKS · LIGHTNING ARRE
PACKAGED SUBSTATIONS · CAPACITORS · F
LINE CONSTRUCTION MATERIALS · PORCELAIN IN

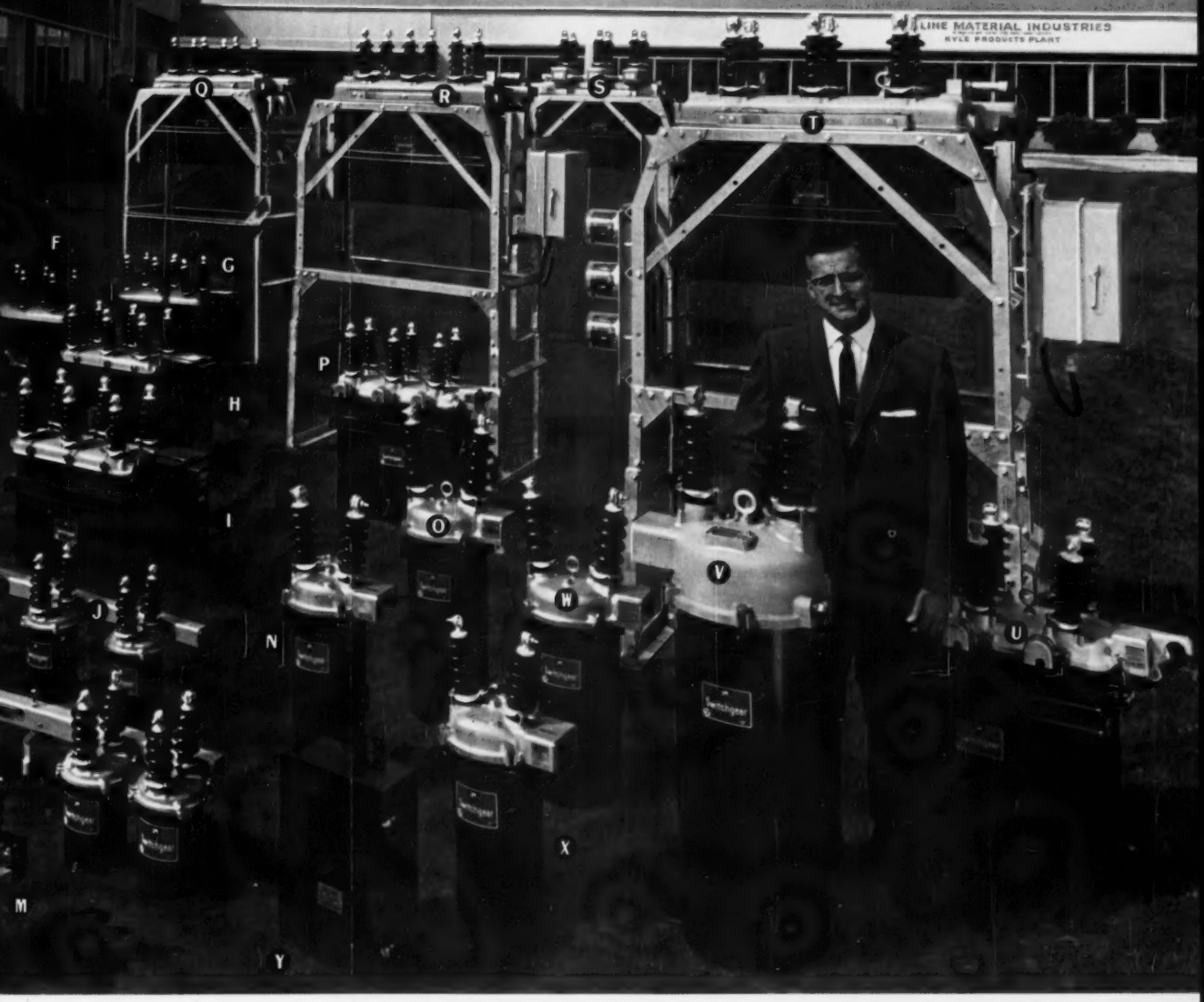
544

nplete Line Switchgear

zers...Oil Switches

Announces The New TYPE D

Power Class III Single-Phase Recloser



ERS, SECTIONALIZERS AND OIL SWITCHES
G ARRESTERS · POWER SWITCHING EQUIPMENT
ORS · REGULATORS · OUTDOOR LIGHTING
AIN INSULATORS · FIBRE PIPE AND CONDUIT

544

Type D—another cost-saving addition to L-M's complete recloser line from L-M Research and Development.

Blaine Schultz, Manager of Engineering, Kyle Products, presents the new L-M Type D Single-Phase automatic oil circuit recloser. This is the latest product of L-M's continuing program of providing electric utilities with overall, low-cost system protection. Type D Power Class III reclosers provide protection against faults up to 12000 amperes.

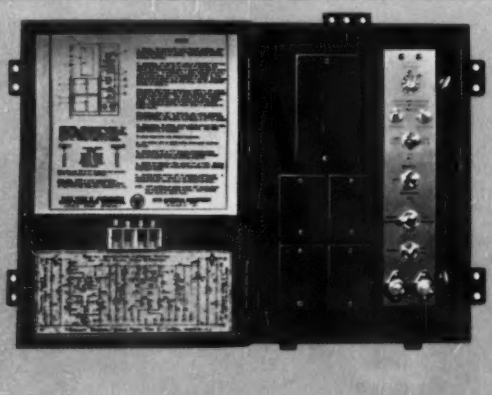
WHAT L-M's COMPLETE LINE OFFER

10,000 Reclosers—VOLTAGE AND CURRENT RATINGS

Continuous Current Rating-Amperes	Minimum Trip Rating-Amperes	DISTRIBUTION CLASS	INTERRUPTING RATINGS—RMS SYMMETRICAL AMPERES																		
		95 KV BIL 2.4-14.4 KV	POWER CLASS																		
			110 KV BIL 2.4-14.4 KV																		
			Class I			Class II									Class III						
		Single-Phase Type H Three-Phase Type 3H	Single-Phase Type 4H Three-Phase Type 6H			Single-Phase Type L			Three-Phase Type R			Three-Phase Type RE			Single-Phase Type D			Three-Phase Type		
		2.4-14.4 KV	4.8 KV	8.32 KV	14.4 KV	4.8 KV	8.32 KV	14.4 KV	4.8 KV	8.32 KV	14.4 KV	4.8 KV	8.32 KV	14.4 KV	4.8 KV	8.32 KV	14.4 KV	4.8 KV	8.32 KV	14 K
5	10	125	200	200	200																
10	20	250	400	400	400																
15	30	375	600	600	600																
25	50	625	1000	1000	1000	1500	1500	1500	1500	1500	1500										
35	70	875	1400	1400	1400	2100	2100	2100	2100	2100	2100										
50	100	1250	2000	2000	2000	3000	3000	3000	3000	3000	3000	3000	3000	3000							
70	140		3000	2500	2000	4200	4200	4000	4200	4200	4000	4200	4200	4000							
100	200		3000	2500	2000	6000	5000	4000	6000	5000	4000	6000	5000	4000	6000	6000	6000	6000	6000	60
140	280					6000	5000	4000	6000	5000	4000	6000	5000	4000	8400	8400	8000	8400	8400	80
160	320								6000	5000	4000				9600	9600	8000	9600	9600	80
185	370								6000	5000	4000				11100	10000	8000	11100	10000	80
200	400					6000	5000	4000				6000	5000	4000						
225	450								6000	5000	4000				12000	10000	8000	12000	10000	80
280	560					6000	5000	4000	6000	5000	4000	6000	5000	4000	12000	10000	8000	12000	10000	80
400	800								6000	5000	4000	6000	5000	4000	12000	10000	8000	12000	10000	80
400X	560								6000	5000	4000							12000	10000	80
560	1120														12000	10000	8000	12000	10000	80
560X	750																	12000	10000	80

2800 Oil Switches—A SWITCH FOR EVERY NEED

		2.4 KV THROUGH 7.2 KV											7.2 KV THROUGH 14.4 KV										
		95 KV BIL OIL SWITCHES				110 KV BIL OIL SWITCHES							95 KV BIL OIL SWITCHES				110 KV BIL OIL SWITCHES						
	% P.F.	N	NR	NM	NV	VH	VM	VR	VLH	VLM	VLR	VCR	N	NR	NM	NV	VH	VM	VR	VLH	VLM	VLR	VCR
50 AMPERES	10- 50 LAG	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	
	50- 75 LAG	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	
	75-100 LAG	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	
	O-Lead	x	x	x	x	x	x	x				x	x	x	x	x	x	x	x				x
100 AMPERES	10- 50 LAG								x	x	x									x	x	x	
	50- 75 LAG	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	
	75-100 LAG	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	
	O-Lead	x	x	x	x	x	x	x				x	x	x	x	x	x	x	x				x
150 AMPERES	10- 50 LAG								x	x	x									x	x	x	
	50- 75 LAG					x	x	x	x	x	x									x	x	x	
	75-100 LAG	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	
	O-Lead	x	x	x	x	x	x	x				x	x	x	x	x	x	x	x				x
200 AMPERES	10- 50 LAG								x	x	x									x	x	x	
	50- 75 LAG					x	x	x	x	x	x									x	x	x	
	75-100 LAG	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	
	O-Lead					x	x	x				x					x	x	x				x
300 AMPERES	10- 50 LAG								x	x	x									x	x	x	
	50- 75 LAG								x	x	x									x	x	x	
	75-100 LAG					x	x	x	x	x	x									x	x	x	
	O-Lead					x	x	x				x					x	x	x				x
400 AMPERES	10- 50 LAG								^	x	x									x	x	x	
	50- 75 LAG								x	x	x									x	x	x	
	75-100 LAG					x	x	x	x	x	x									x	x	x	



Over 2800 combinations of field and factory-installed accessories on the Type N and V line of oil switches serve a multitude of applications on 2.4 to 14.4 kv circuits. Manual, remote, or automatic control.

TYPE S CONTROL (LEFT) provides reliable automatic transfer of load from one source to another. Simplifies engineering of radial feed systems, when the Type S provides single or 3-phase control with L-M's Type NR, VR, or VLR automatic oil switches.

L-M'S LATES
system prote
three-phase
(rear) offers
simplicity in
changes. Ne
III single-pha

Over 10,000
tics are avai
tion of reclo
offered in 11
variety in vo

ERS YOU

					150 KV BIL 2.4-23 KV	
s III						
e Type W		Three-Phase Type WE			Single-Phase Type E*	
2	14.4 KV	4.8 KV	8.32 KV	14.4 KV	14.4 KV	23 KV
					200	200
					400	400
					600	600
					1000	1000
					1400	1400
					2000	2000
					2500	2500
00	6000	6000	6000	6000	2500	2500
00	8000	8400	8400	8000		
00	8000					
00	8000					
		12000	10000	8000		
00	8000					
00	8000	12000	10000	8000		
00	8000	12000	10000	8000		
00	8000					
00	8000	12000	10000	8000		
00	8000					

*Electrical interconnection available to give three-phase lockout.

ATEST CONTRIBUTIONS to low-cost protection. Type WE Power Class III hase recloser with electronic control ffers maximum application flexibility with y in system coordination and field s. New Type D is the only Power Class e-phase recloser on the market.

●

0,000 optional operational characteris- available to provide the widest selec- reclosers today. Low-cost protection is in 11 different types of reclosers with a in voltage, class, and amperage rating.

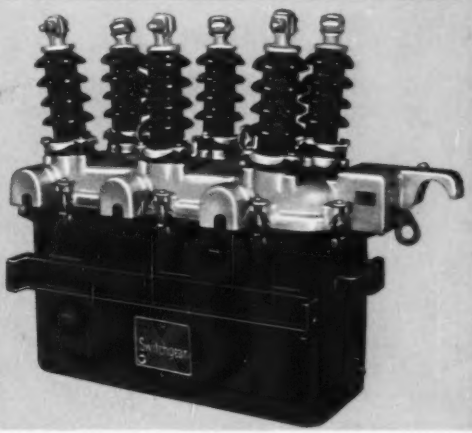
36 Sectionalizers—CURRENT RATINGS

COIL CONTINUOUS RATING—AMPERES	LOAD SWITCHING RATING—AMPERES	ACTUATING CURRENT RATING—AMPERES	SHORT TIME RATING—RMS ASYMMETRICAL AMPERES					
			95 KV BIL 2.4—14.4 KV			110 KV BIL 2.4—14.4 KV		
			SINGLE-PHASE TYPE GH			THREE-PHASE TYPE GN3		
			MOMENTARY & MAKING	1 SEC.	10 SEC.	MOMENTARY & MAKING	1 SEC.	10 SEC.
5	11	8	800	200	80	800	200	80
10	22	16	1600	400	125	1600	400	125
15	33	24	2400	600	190	2400	600	190
25	55	40	4000	1000	325	4000	1000	325
35	77	56	6000	1500	450	6000	1500	450
50	110	80	6500	2000	650	7000	2000	650
70	144	112	6500	3000	900	8000	3000	900
100	200	160	6500	4000	1250	8000	4000	1250
140	200	225	6500	4000	1800	8000	4000	1800
160	200	256				9000	5700	2600
185	200	296				9000	5700	2600
200	200	320				9000	5700	2600

36 combinations of trip ratings and counting options make L-M's GH single-phase or GN3 three-phase sectionalizers a most economical method for automatically isolating permanent faults on 2.4 to 15 kv distribution branch circuits, when applied in conjunction with a back-up recloser.

●

L-M'S TYPE GN3 (RIGHT) is the most recent development in sectionalizers. Only three-phase sectionalizer available today.



L-M Switchgear Provides Lower Overall System Costs

Application of Line Material reclosers throughout your system offers savings in many ways. Lower purchase costs, and lower installing cost cut your initial investment. Lower operating costs and reduced maintenance provide long range savings.

Lower Initial Cost

Application of L-M reclosers as the automatic disconnecting device throughout your distribution system eliminates the initial high costs of circuit breakers and associated relaying equipment. Less land is needed. Installation labor is cut about 50%.

Lower Operating Costs

L-M reclosers detect and interrupt fault currents and automatically reclose. This effectively reduces the outage time caused by transient or non-persistent faults. Fast operating characteristics of reclosers, less than 2 cycles, minimize annealing or burn-down of bare or covered conductors and increase service continuity, because over 90% of all faults are of a temporary nature.

Get Complete Information

Ask your Field Engineer for more information on how L-M switchgear can be profitably applied to your system. Or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: CLM Industries, McGraw-Edison (Canada) Limited, Toronto 13, Canada.

LINE MATERIAL® Industries

McGRAW-EDISON COMPANY

Reclosers, Sectionalizers, and Oil Switches

DISTRIBUTION TRANSFORMERS · RECLOSERS, SECTIONALIZERS AND OIL SWITCHES
FUSE CUTOUTS AND FUSE LINKS · LIGHTNING ARRESTERS · POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS · CAPACITORS · REGULATORS · OUTDOOR LIGHTING
LINE CONSTRUCTION MATERIALS · PORCELAIN INSULATORS · FIBRE PIPE AND CONDUIT

PUT THESE IN YOUR POWER PICTURE:

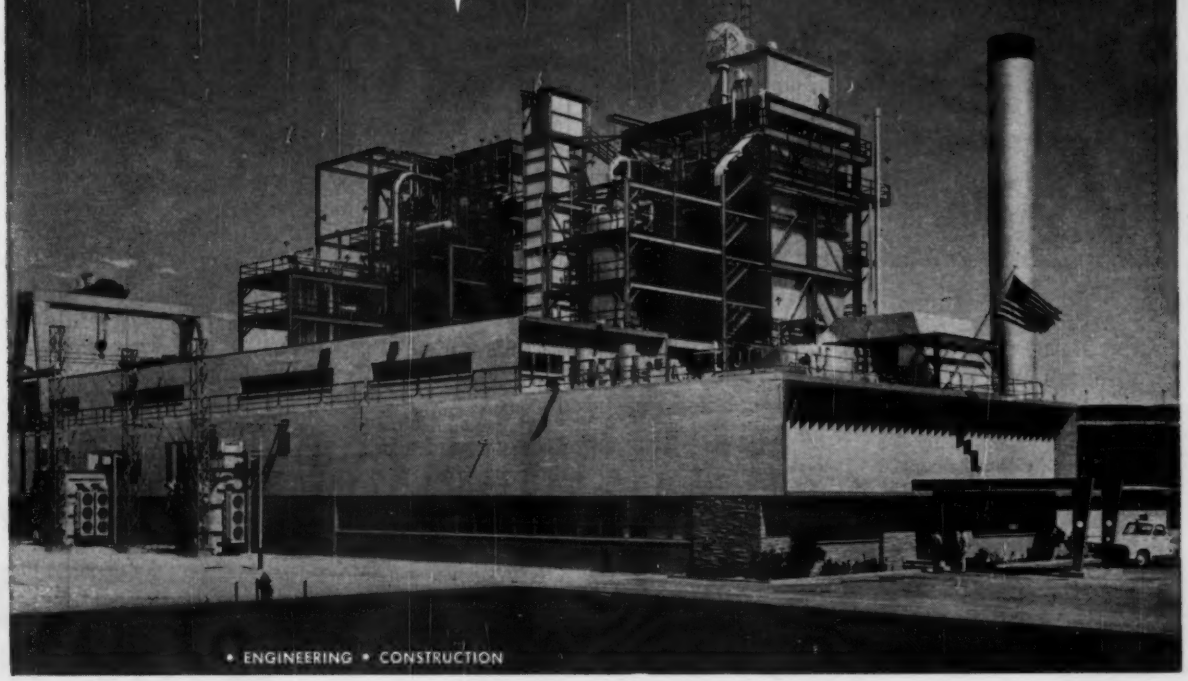
YESTERDAY'S EXPERIENCE.....
TODAY'S PRACTICE.....
TOMORROW'S PERFORMANCE...

Power plants by Stearns-Roger contain 75 years of engineering-construction background and the best of today's design concepts. With our help you can meet tomorrow's power requirements efficiently and economically. Your plant will incorporate equipment and configuration for precision operation and will provide for tomorrow's expansion. Your power facilities are our business.

Stearns-Roger

THE STEARNS-ROGER MFG. CO. • DENVER, COLORADO

P.O. Box 5888 • Denver 17, Colorado



• ENGINEERING • CONSTRUCTION

Again, Lapp leads the way to help you increase substation efficiency . . . to reduce construction and maintenance costs.

Here is Lapp ***Hi-F***—in Station Posts—a new, but fully-accredited member of the Lapp family of Station Posts. ***Hi-F*** adds another "strength class" to the Lapp Station Post series, and is offered as a realistic 1961 answer to a majority of substation insulator operating requirements.

You see, it has been 30 years since Lapp introduced the Station Post design with all its improvements over conventional cap-and-pin station insulators. In the beginning, and to answer expected skepticism in the field regarding such a "revolutionary new design," we rated the original Lapp Station Posts conservatively—providing generous factors of safety in all mechanical values.

In the 30 years since, physical dimensions of Lapp Posts have been changed little. Materials and manufacturing techniques have been improved notably, however, with resulting increases in test characteristics and uniformity. Today standard-strength Lapp Station Posts qualify as substantial "over-design" in most applications for which they are used.

In the new series of Lapp ***Hi-F*** Station Posts, each unit—7.5 kv through 69 kv—is rated at 1,000-lbs. cantilever (both in upright and underhung positions), a strength adequate for almost all present substation use. In electrical ratings ***Hi-F*** matches EEI-NEMA values for standard Station Posts, and ***Hi-F*** is physically interchangeable with standard Station Posts. For application under high short-circuit stress or other requirement for higher cantilever, we still offer Lapp Station Posts in standard, high-strength, and extra-high-strength types, with strengths respectively of 2,000, 4,000 and 8,000 lbs.

Lapp's contribution in ***Hi-F*** Station Posts is that of providing *another* station insulator choice—to help you specify what you need, and pay only for what you can use.

Lapp

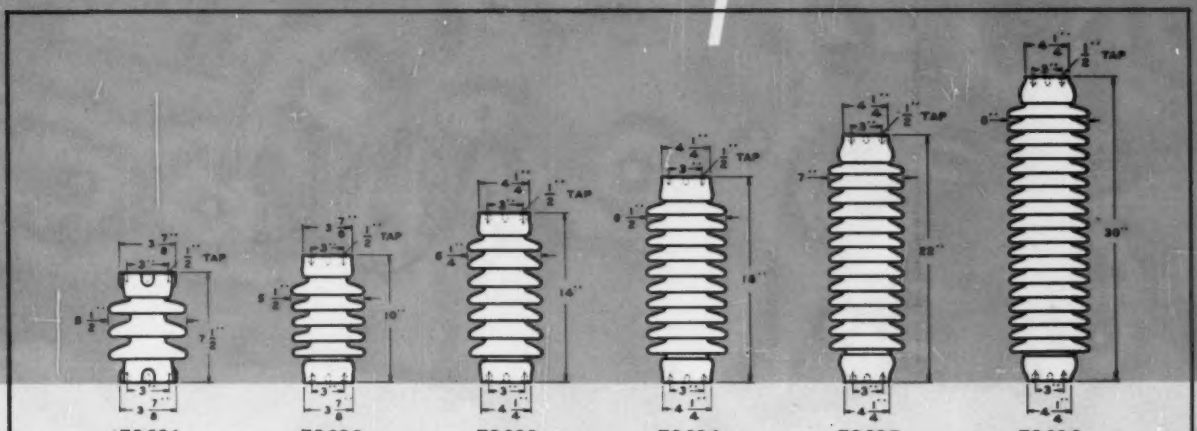
Lapp Insulator Co. Inc., LeRoy, N. Y.

STATION POSTS

FUNCTIONAL DESIGN FOR NORMAL DUTY SWITCH AND BUS SUPPORT ...AND INTERCHANGEABLE WITH STANDARD STATION POSTS (same heights and bolt circles)

1000 LB. CANTILEVER STRENGTH... UPRIGHT OR UNDERHUNG

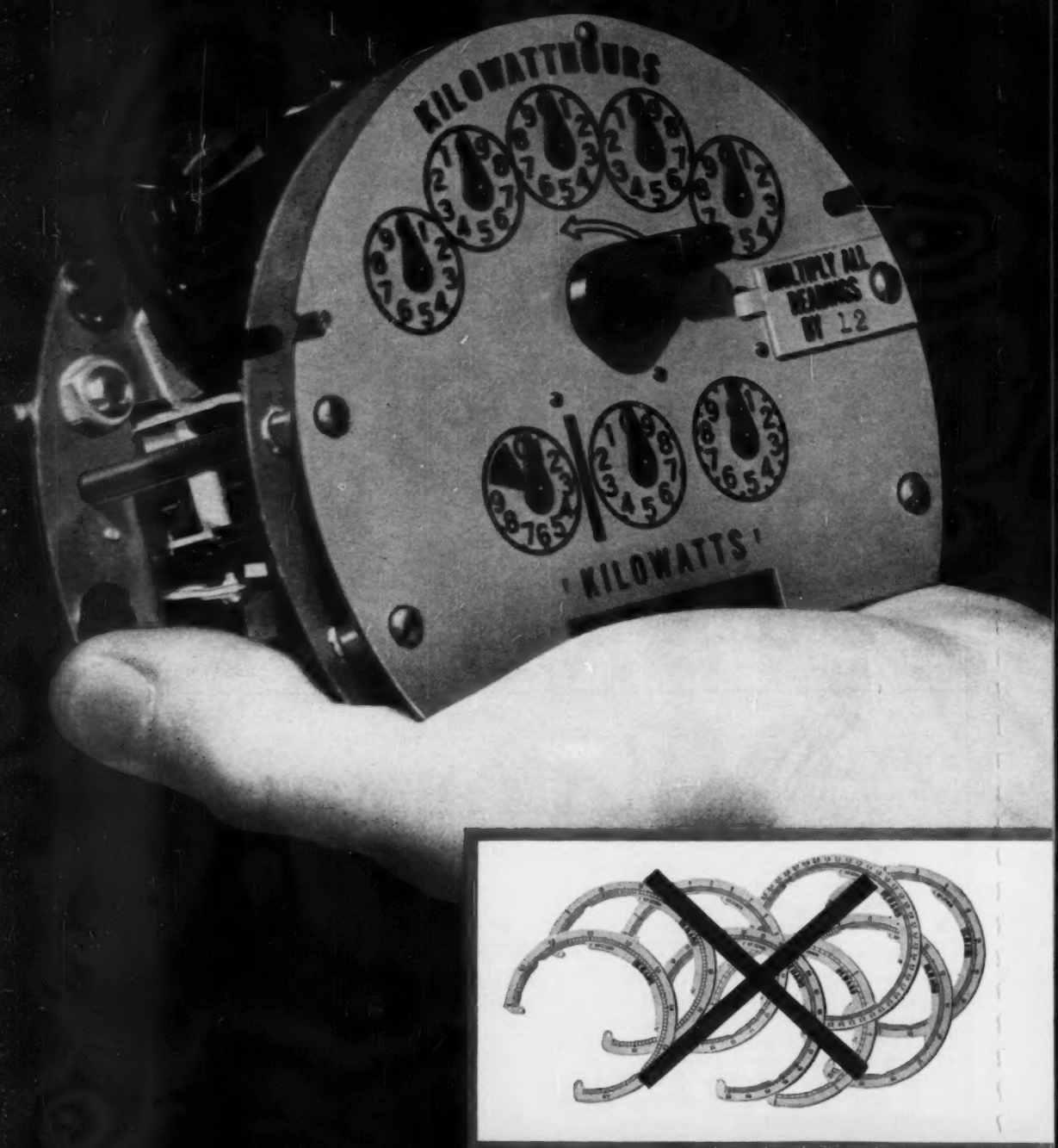
MEET EEI-NEMA STANDARDS IN ALL ELECTRICAL VALUES...



Catalog Number	73631	73632	73633	73634	73635	73636
DIMENSIONS						
Leakage Distance, Inches	10.5	15.5	24	37	43	72
Dry Arcing Distance, Inches	6	7.25	10.5	14.5	17	26
MECHANICAL VALUES						
Cantilever Strength, Pounds, Upright	1,000	1,000	1,000	1,000	1,000	1,000
Cantilever Strength, Pounds, Underhung	1,000	1,000	1,000	1,000	1,000	1,000
Tension Strength, Pounds	5,000	5,000	5,000	7,000	8,000	12,000
Torsion Strength, Inch-Pounds	6,000	7,000	8,000	10,000	12,000	15,000
Compression Strength, Pounds	10,000	10,000	10,000	15,000	15,000	25,000
ELECTRICAL VALUES						
Voltage Rating, kv	7.5	15	23	34.5	46	69
Low Frequency Dry Flashover, kv	60	85	110	145	170	235
Low Frequency Wet Flashover, kv	40	55	75	100	125	180
Impulse Flashover—Positive, kv	105	125	170	225	280	390
Impulse Flashover—Negative, kv	120	200	250	290	340	475
Low Frequency Withstand—1 Min. Dry, kv	35	50	70	95	120	175
Low Frequency Withstand—10 Sec. Wet, kv	30	45	60	80	100	145
Impulse Withstand, kv	95	110	150	200	250	350
RADIO INFLUENCE VOLTAGE DATA						
Test Voltage—Rms to Ground, kv	5	10	15	22	30	44
Maximum RIV—Microvolts at 1000 kc	50	50	100	100	200	200
PACKING AND SHIPPING DATA						
Net Weight, Each, Pounds	10	14	22	34	42	74
Packed Weight, Each, Pounds	11.5	17	25.5	39	51	85
Standard Package	6	3	3	3	2	2

GENERAL ELECTRIC ANNOUNCES . . .

Breakthrough in Demand Metering



YOU ELIMINATE the cost and confusion of over 120 scale plates with new, exclusive three-dial demand indication of General Electric's M-60 register. Twenty times longer scale length gives unmatched readability. Readings are faster, more accurate, increase revenue.

NEW Dial-type M-60 Demand Register Obsoletes Scale Plates, Doubles Life

Dial-type demand indication—a long awaited breakthrough in demand metering—is achieved in General Electric's new M-60 register. This innovation, plus others, offers electric utilities new opportunities for significant savings. For example:

You slash inventory costs. Exclusive three-dial demand indication completely eliminates more than 120 scale plates . . . provides 190-inch effective scale length—20 times longer than any register—makes the M-60 a true universal register with extended load range capacity and highest known resolution for maximum application flexibility, lower inventory.

You cut replacement cost 50%. Test-proved 25-year service life of timing motor is double that of any register . . . for the first time matches register life with watthour meter life.

You reduce maintenance costs. No calibration adjustments required . . . new magnetic interval reset provides positive reset automatically. Timing motor requires no maintenance over 25-year service life.

You reduce reading errors. Direct reading of demand information reduces required reading skill, eliminates confusion caused by varying scale plates . . . readings are faster, more precise.

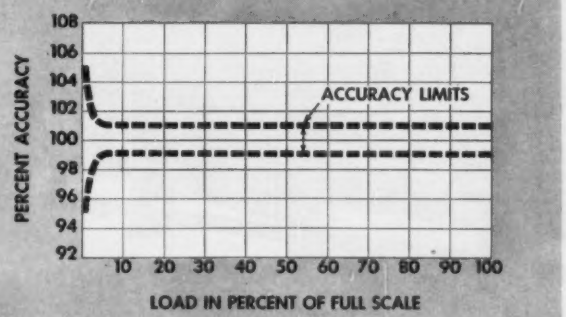
You get 'added value' for same initial price. General Electric's new M-60 is priced the same as old-style sweep-pointer registers . . . a real metering value.

New M-60 installs on all G-E single-phase and polyphase magnetic-suspension meters. Time intervals of 15, 30 or 60 minutes available. Unlimited load capacity. Contact your G-E Sales Engineer for the full story of this demand metering breakthrough. Or write General Electric Co., Somersworth, N.H.

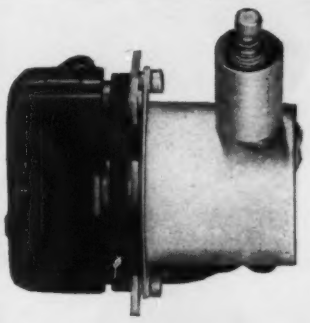
710-01

Progress Is Our Most Important Product

GENERAL ELECTRIC



NEW GENERAL ELECTRIC M-60 demand register measures the majority of loads within a fraction of a kilowatt . . . ±1% at all KW values above five percent of register capacity. Accuracy is not related to full scale value, as present registers are.



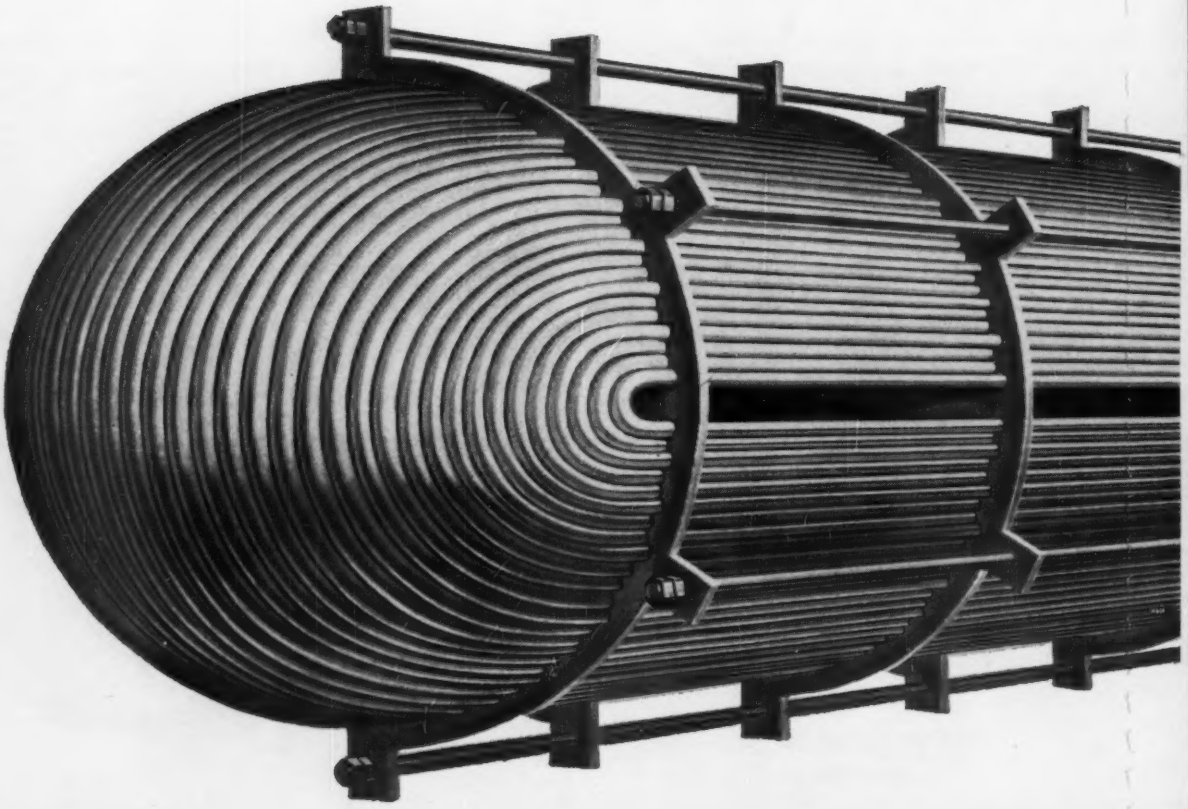
NEW TIMING MOTOR has test-proved service life of 25 years. Complete unit—3600-rpm hysteresis rotor and Geneva gear train—is hermetically-sealed in tinned-copper case filled with silicone oil lubricant. Operates indoors or outdoors in all climates.

Another New Extra High Strength
Condenser Tube Developed by

PHELPS DODGE!

CUFENLOY-40

With 15% Higher Strength than
any other Copper-Nickel Alloy
Now Available!



In August 1959, Phelps Dodge introduced the first high strength copper-nickel alloy condenser tube, Cufenloy-30. Now Phelps Dodge offers Cufenloy-40, a copper-nickel alloy with greatly increased strength suitable for the most severe applications in high pressure feedwater heaters. The mechanical and physical properties of this exclusive new alloy make possible substantial reductions in the cost of feedwater heaters. Cufenloy-40 has received approval for ASME Code applications through Case 1300 (Special Ruling).

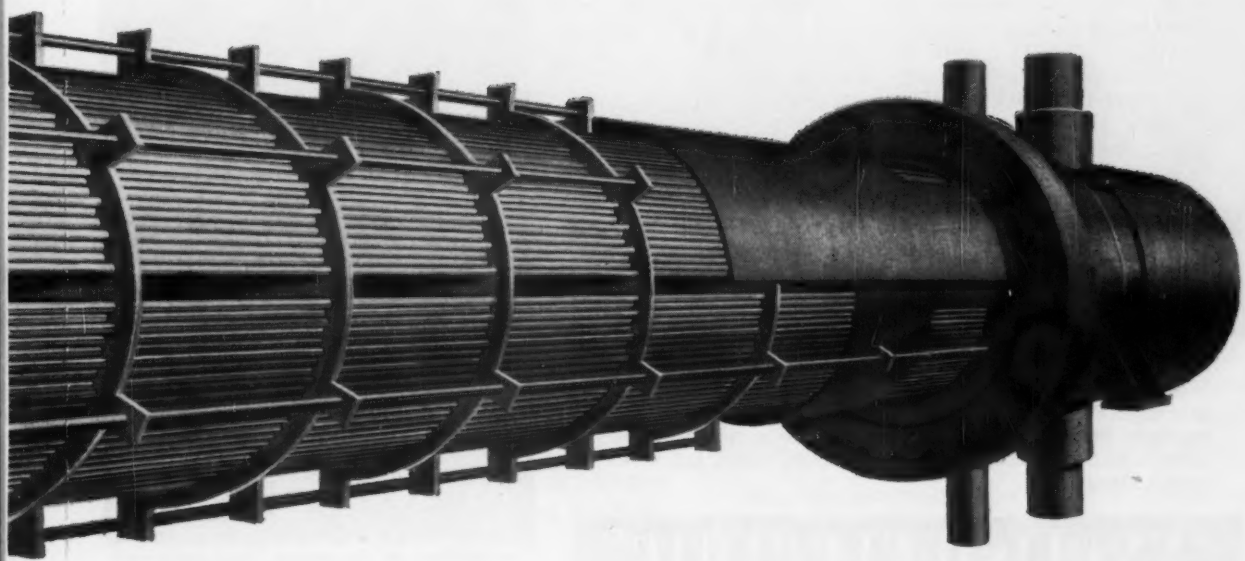
Weldability. Extensive tests in Phelps Dodge's laboratories were performed to determine Cufenloy-40's welding characteristics. Standard welding procedures used for 70/30 copper nickel tubes were found to be fully acceptable for this new composition. Pull-out, Cycling and Pressure Tests confirmed that a maximum joint efficiency was obtained using these procedures.

Corrosion Resistance. Corrosion studies have been performed on Cufenloy-40 since 1959 and have shown it to be unsusceptible to stress corrosion cracking in a moist ammonia and carbon dioxide atmosphere. In these tests Cufenloy-40 also proved virtually immune to general chemical attack. It is believed that Cufenloy-40 has the best overall corrosion resistance of the copper-nickel alloys.

Dual Gauge. Cufenloy-40 condenser tubes are available in dual gauges wherever a thickened wall section is needed to compensate for thinning on tight radius bends.

U-Bent Tubes. Cufenloy-40 tubes are also furnished in factory "U" bends for immediate tubing into the unit at the manufacturer's plant or on the job site.

Further Information from your local Phelps Dodge sales office, or write Dept. 2B for the Cufenloy-40 technical brochure.



PHELPS DODGE COPPER PRODUCTS
CORPORATION
300 Park Avenue, New York 22, N.Y.

P MINE TO MARKET D

IN U.S.A. A model of the runner for one of the eight 90,300 h.p. propeller turbines to operate at a head of 67 feet. These are being built in Canada for Big Bend Reservoir, South Dakota.

Power from 'Muddy Waters'

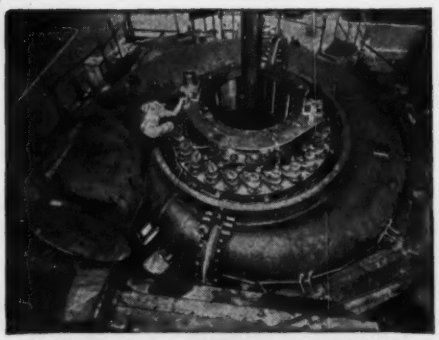
In the land of the old Dakotas (one of the confederated tribes of the powerful Sioux) rises a new dam at Big Bend Reservoir on the Missouri River whose yellow flow near its mouth gave rise to its name, 'Muddy Waters'.

Harnessed by the U.S. Army Corps of Engineers, these waters will provide electric power for the development of industry and agriculture throughout South Dakota and other states in the Missouri River Basin.

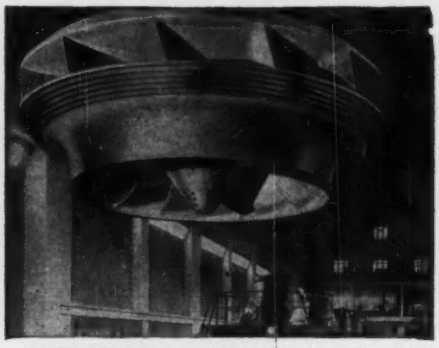
Eight propeller water turbines for this project are now being built in Canada to 'ENGLISH ELECTRIC' designs by John Inglis Co. of Toronto, a member of the world-wide 'ENGLISH ELECTRIC' Group of Companies.

Amongst the notable hydro power stations in North America equipped by 'ENGLISH ELECTRIC' are Beauharnois No. 3 and Robert H. Saunders on the St. Lawrence; Priest Rapids and McNary on the Columbia; Table Rock on the White River, Missouri; Chute-des-Passes and Bersimis in Quebec; and the Canadian Niagara pumped-storage station.

With factories in five continents, the Group is near at hand to any undertaking needing power engineering and can provide anything from a small individual drive to a comprehensive scheme with generating plant using steam, water, gas, oil or atomic energy.



IN WALES Works assembly of one of four 105,000 h.p. Francis turbines for a head of 970 feet, to be installed at Ffestiniog Pumped-Storage Station.



IN AUSTRALIA. Four high-head Francis turbines and a spare runner supplied to the Tumut 1 Station, Snowy Mountains. These turbines, which can deliver 129,000 h.p. at 1,065 feet head, are amongst the most powerful at this head in the world.

'ENGLISH ELECTRIC'

Agents: ENGLISH ELECTRIC CORPORATION, 750 Third Avenue, New York 17, N.Y. Telephone: MURRAY HILL 7-0303

Sub-Agents:

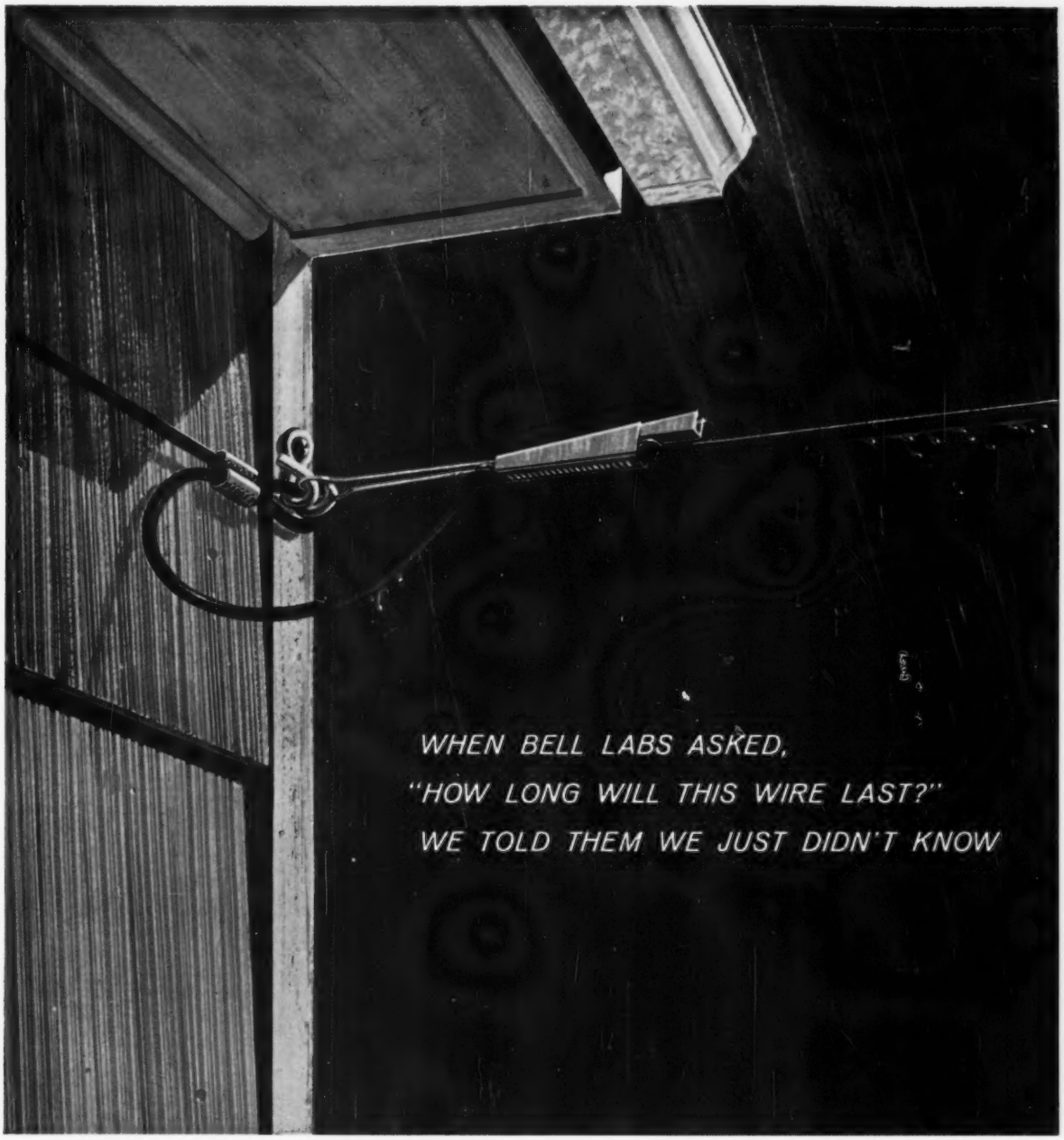
FOR GEORGIA, ALABAMA, TENNESSEE AND SOUTH CAROLINA — Osgood & Associates, Inc., 988 Spring Street, N.W., P.O. Box 7383, Station C, Atlanta, Georgia. Tel: TRinity 5-7804/5

FOR MASSACHUSETTS, RHODE ISLAND, MAINE, NEW HAMPSHIRE AND VERMONT — Flagg, Brackett & Durgin, Inc., 183 Essex Street, Boston 11, Massachusetts. Tel: HUbbard 2-4120

FOR SOUTHERN FLORIDA — Charles R. Lee & Associates, Inc., 3796 West Flagler Street, Miami 44, Florida. Tel: HIghland 4-7414

FOR LOUISIANA AND SOUTHERN MISSISSIPPI — Lyman C. Reed, Inc., 501 North Saint Patrick Street, New Orleans 19, Louisiana. Tel: HUnter 2-3106

OC/US/10



And 19 years later—we still don't! Since 1942, over 8 billion feet of neoprene covered telephone drop wire has gone into pole-to-home service throughout the country. Some of it will soon mark its 20th anniversary, with the neoprene in such good condition that its ultimate life is still a question.

Recently, as part of a test program, Bell Laboratories cut down a piece of this drop wire which had seen outdoor service in Los Angeles since 1946. Exhaustive testing proved the neoprene covering virtually as good as the day it came off the reel. Tough as a tendon. Supple as muscle. Practically unblemished by the unending assaults of sun, ozone, airborne chemicals, high and low temperatures. Elongation of the 15-year-old sample measured at 130%, tensile at 1905 psi (more than 70% of the original psi)!

Neoprene synthetic rubber offers this kind of long-term reliability to wire and cable of all types. For information, write E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department EW-12, Wilmington 98, Delaware.

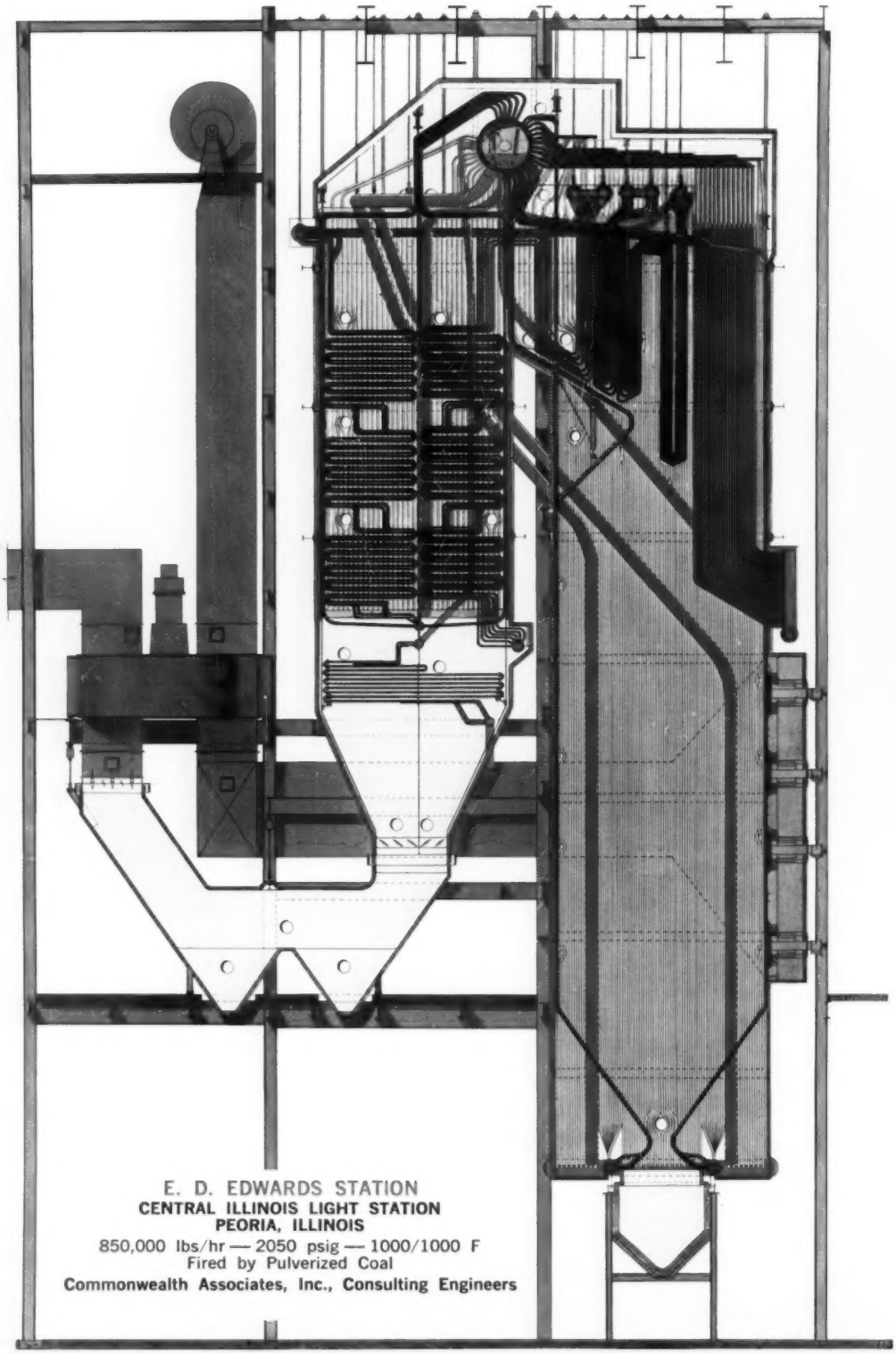
DU PONT REG. U. S. PAT. OFF.

NEOPRENE
SYNTHETIC RUBBER

Better Things for Better Living . . . *through Chemistry*

Central Illinois Light Company has

850,000 lb/hr Boiler at

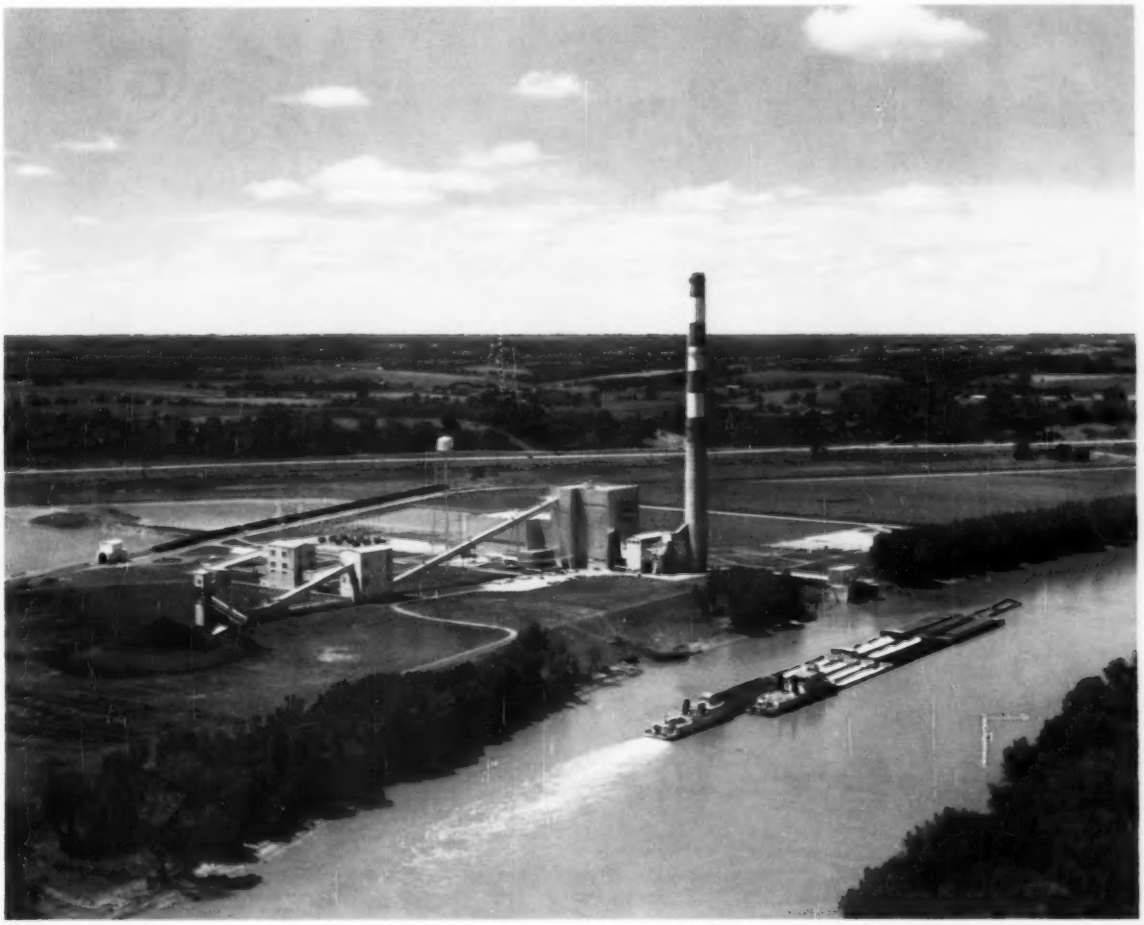


E. D. EDWARDS STATION
CENTRAL ILLINOIS LIGHT STATION
PEORIA, ILLINOIS
850,000 lbs/hr — 2050 psig — 1000/1000 F
Fired by Pulverized Coal
Commonwealth Associates, Inc., Consulting Engineers

A careful survey of your plant by a qualified consulting engineer could show ways of making substantial savings in power costs.

another good **RILEY** *performer*

E. D. EDWARDS STATION



Central Illinois Light Company has purchased Riley Steam Generating Equipment since 1938. The latest, this 850,000 lb/hr reheat boiler, brings CILCO's total steam capacity with Riley boilers to 3,415,000 lb/hr. Six Riley boilers in operation at CILCO's R. S. Wallace Station at East Peoria, Illinois are continuing to provide dependable operation with records of high availability.

The new Riley boiler at the E. D. Edwards Station, which started operation in April, 1960, is living up to the reputation established by its predecessors.

Reheat steam temperature is controlled by gas flow dampers located below economizer; superheat is controlled by spray. Water tube platens in furnace add to furnace cooling and produce uniform furnace exit temperatures.

Central Illinois Light Company is one of many investor owned electric utilities that have repeatedly purchased Riley equipment. Today, many electric utility customers are installing Riley equipment because they recognize Riley's progressive design of boilers tailored to the requirements of the Electric Power Industry.

Investigate Riley's newest boiler designs. Call your local Riley representative or write RILEY STOKER CORPORATION, WORCESTER, MASSACHUSETTS.

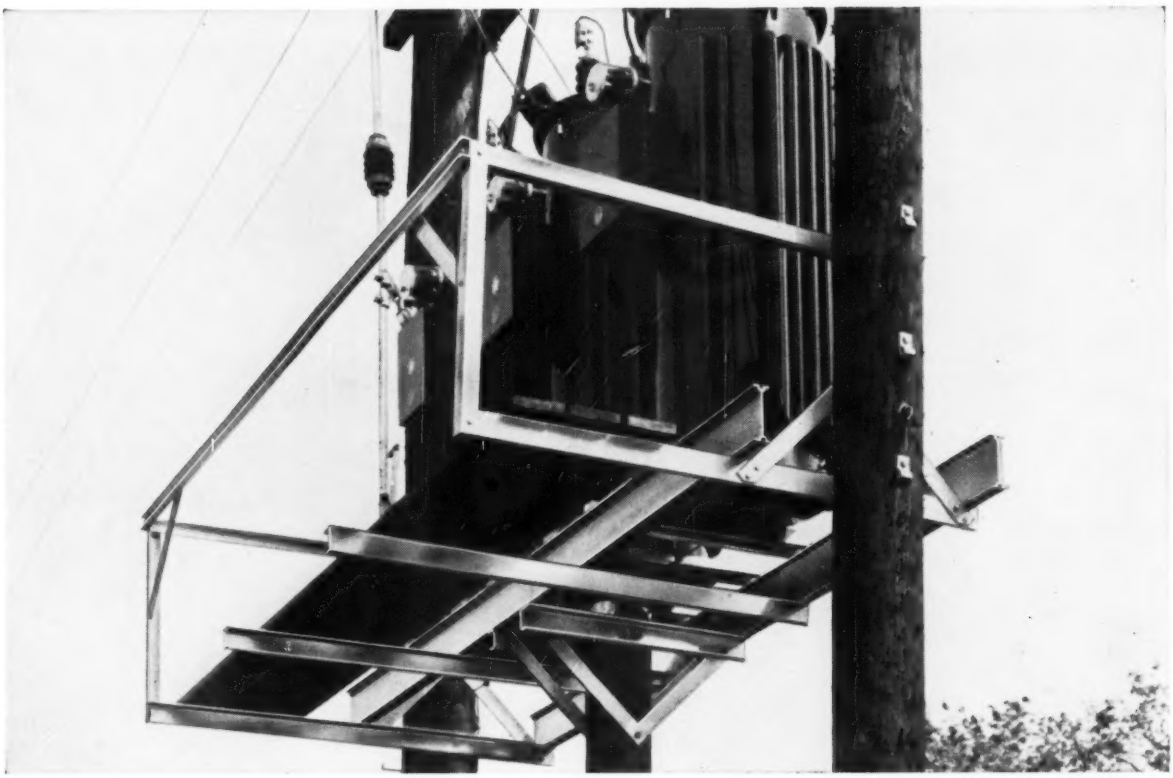
SALES OFFICES

Boston, Charlotte, Chicago, Cincinnati, Cleveland, Denver, Detroit, Honolulu, Houston, Jacksonville, Kansas City, Los Angeles, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Salt Lake City, San Francisco, St. Louis, St. Paul, Seattle, Syracuse.

RILEY

STEAM GENERATING & FUEL BURNING EQUIPMENT

NEW ALUMINUM PLATFORM
for Transformers and Regulators



Light Weight–High Strength–Low Cost

This newly designed platform of Reynolds Aluminum weighs 210 pounds. Two men can have it in place, ready for business, in just 30 minutes. Compare this with a steel platform, same size, that weighs 700 pounds and takes 2½ hours to install. Even though it is produced of high strength aluminum alloy and weighs only one-third that of steel, the platform costs no more. The catwalk pictured on the above platform is optional, and is available for both a 2-pole and 3-pole installation.

Further savings in time and cost resulted from the unique design of the extruded aluminum members. An unlimited number of adjustments can be made in the field to accommodate different size transformers and regulators and no additional holes need be drilled. Only two sizes of fastening bolts are needed, where four were formerly required. In addition, there are the added advantages of minimum maintenance and high resistance to corrosion.

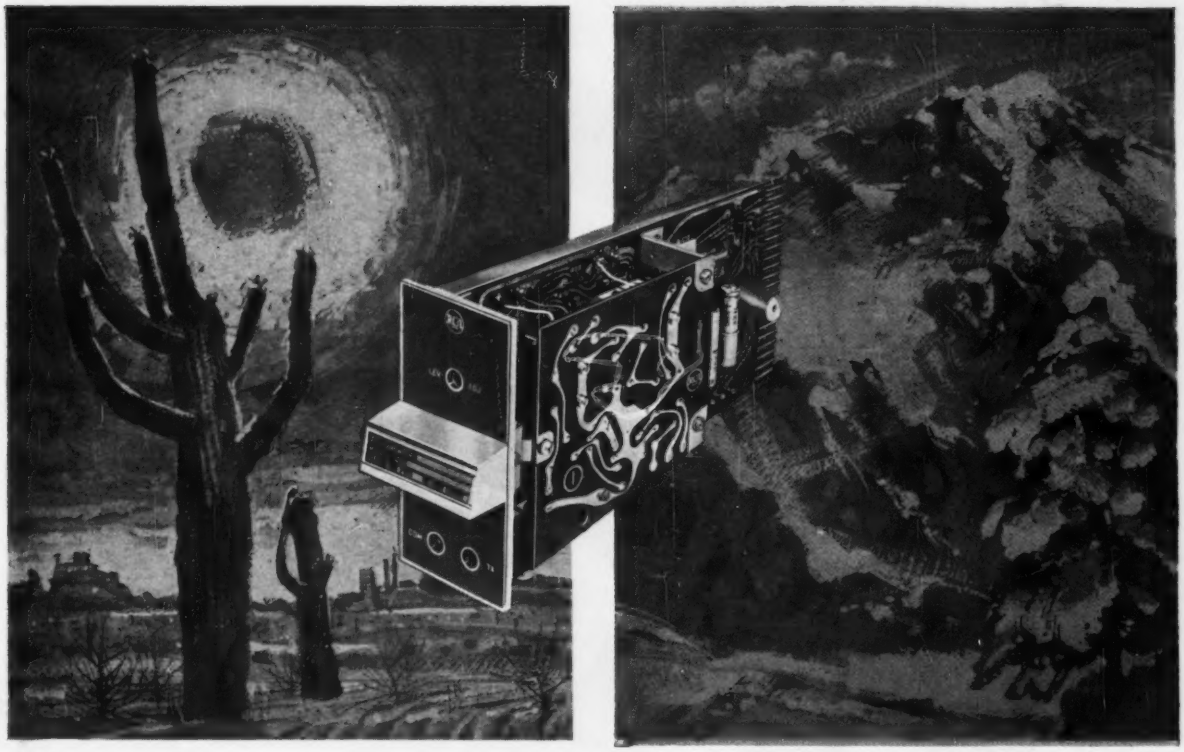
Reynolds Engineers worked very closely with the manufacturer, Utility Products Mfg. Co., P. O. Box 1431, Memphis, Tennessee in designing this platform.

Regardless of whether you purchase or manufacture electrical equipment, aluminum's unique combination of advantages can be of value to you.

Reynolds engineers are available to help translate these advantages into better products for the electrical industry. Contact your nearest Reynolds office or write to *Reynolds Metals Company, P.O. Box 2346-EL, Richmond 18, Va.*

REYNOLDS ALUMINUM

Watch Reynolds exciting TV programs on NBC: the Dick Powell **Reynolds Aluminum Show** every other Tuesday; **Say When** weekdays; and **All Star Golf**—in living color—every Saturday.



NOW...Telemetering Reliability under all environmental conditions with Solid State Multiplex...Type CT-42

Tropic heat . . . arctic cold . . . sustained periods of moisture. New CT-42 provides accurate, reliable telemetering under the widest range of environmental conditions.

Built-in performance assures reliability where you need it the most! Computer grade components and rugged, modular construction provide lasting dependability to not only withstand the rigors of extreme climatic changes, but also to stand up under the grind of continuous service.

For teletype, telemetering, control or data signals, each channel can be frequency-shift or AM keyed. Six transmitters or receivers in any combination may be plugged into a standard shelf that also contains a husky, regulated power supply.

24 channels from 420 to 3180 cps
Spaced every 120 cycles (CCITT Standards)
18 channels from 4300 to 7600 cps
Spaced 170 to 220 cycles
Channel units operate on 24 V DC or a 117 V AC power supply

Environmental Specifications for 100 Word-per-Minute Telegraph Service
Storage Range: —55°C to +85°C
Operating Range: —30°C to +65°C

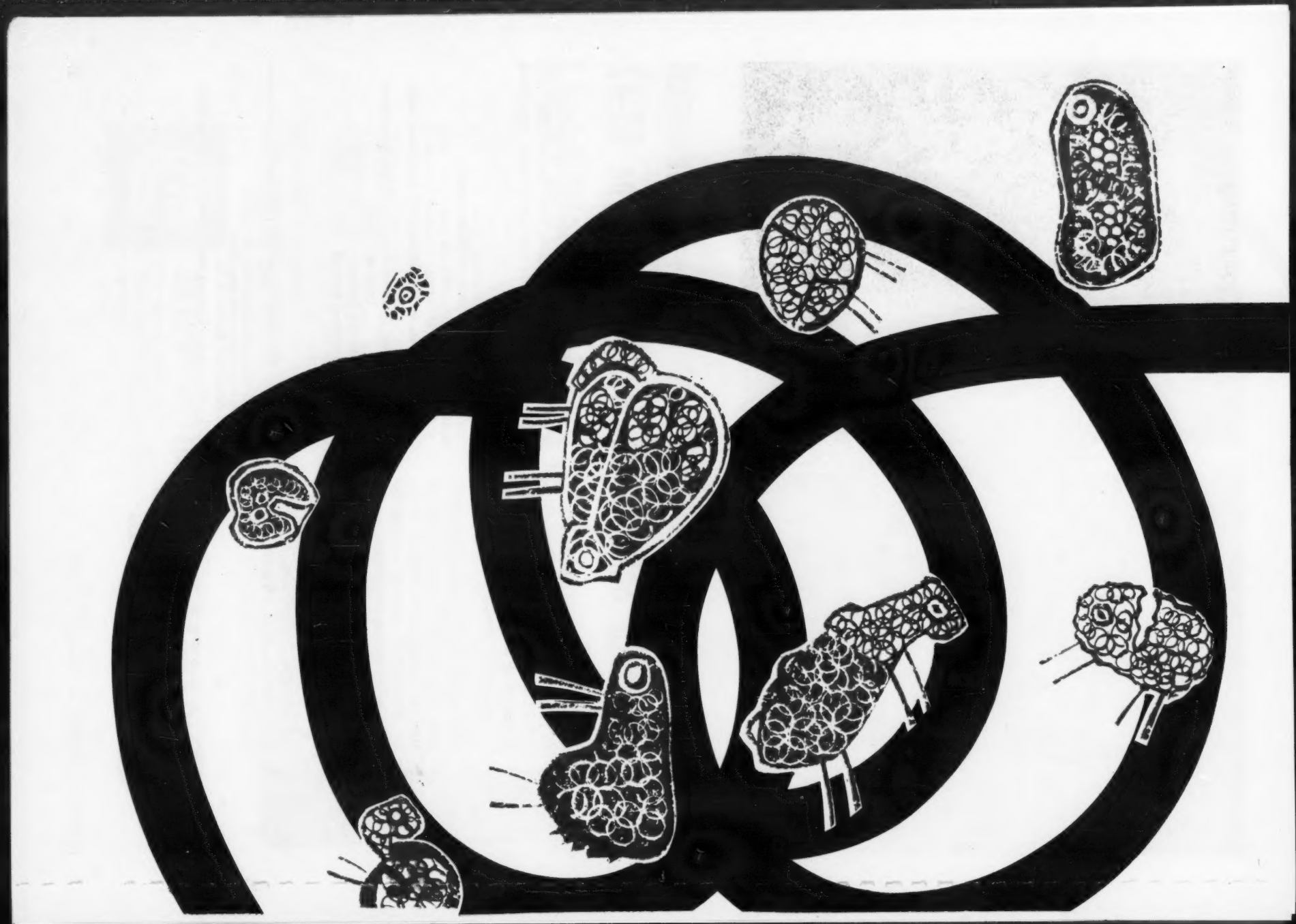
RCA
The Most Trusted Name in Electronics
RADIO CORPORATION OF AMERICA

Mail coupon for additional information

Radio Corporation of America
Microwave Equipment, Dept. CB-45
Building 15-5, Camden 2, N.J.

☐ Please send new catalog sheet and price list on Type CT-42 Tone Equipment

NAME _____ TITLE _____
COMPANY _____
ADDRESS _____
CITY _____ ZONE ____ STATE _____



the difference in electrical cable starts on a fungus farm

Our Research and Development Department grows just about every kind of fungus you can find, and we do it for good reason . . . to make sure you get a better cable. Many of our cables are used in fungi-infested locations. We fight the fungi by including fungitoxic agents in the saturant for insulation tapes and sometimes in the insulating rubber compounds themselves. We can inhibit fungus growth or, where necessary, use even stronger toxicides to kill it completely. So we grow fungi to make sure that USS Tiger Brand cables will give you years of trouble-free service.

This is just one of the many ways our Research and Development Department makes sure the quality of USS Tiger Brand Wire and Cable is the best you can get. Our research laboratory tests all materials used in Tiger Brand products. We experiment with new materials and methods to make USS Tiger Brand Electrical Wire and Cable even better.

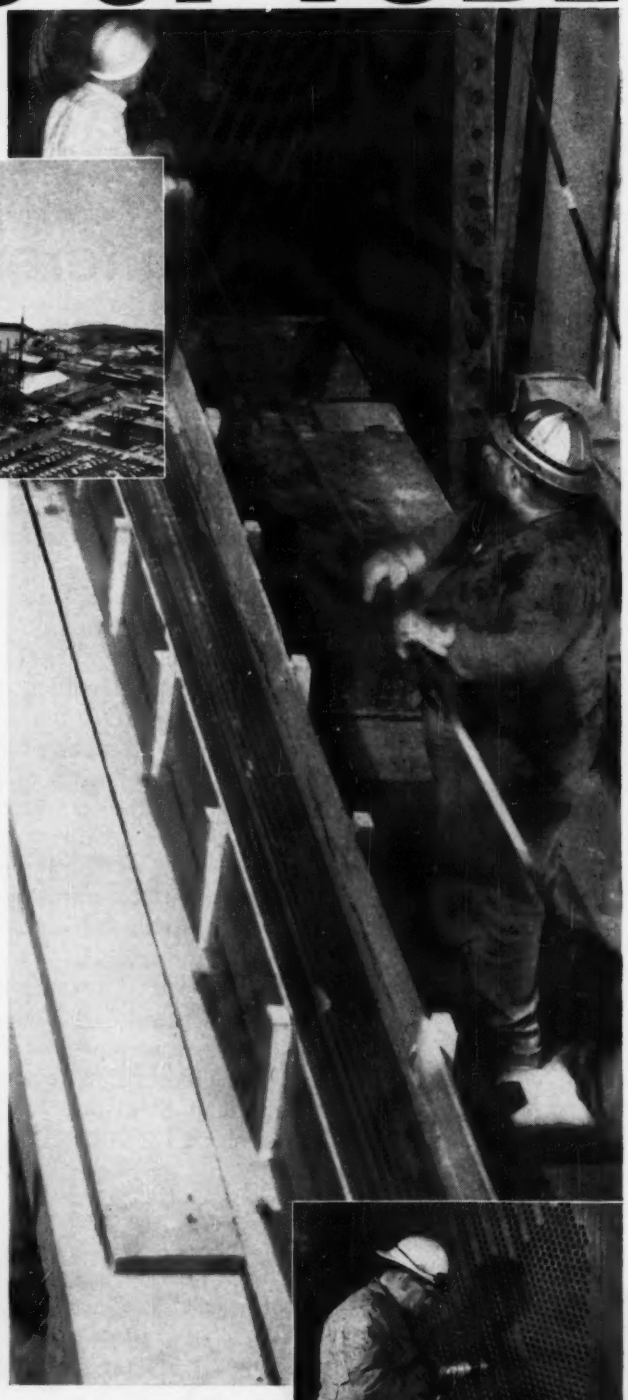
That's why, whatever the job, it pays to specify USS Tiger Brand Electrical Wire and Cable. You can't buy better cable. American Steel and Wire, Dept. 1606, Rockefeller Building, Cleveland 13, Ohio.

USS and Tiger Brand are registered trademarks

American Steel and Wire
Division of
United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Alabama, Southern Distributors
United States Steel Export Company, Distributors Abroad

76 MILES OF TUBE



REVERE ARSENICAL ALUMINUM BRASS CONDENSER TUBE CHOSEN FOR NEW CHARLES P. CRANE STATION OF THE BALTIMORE GAS AND ELECTRIC CO.

At the new Charles P. Crane Station near Baltimore, Md., the No. 1 Unit is now in operation. For this unit, which is served by a divided water box condenser, nearly 76 miles of Revere Arsenical Aluminum Brass condenser tubing was supplied.

The job calls for 398,820 linear feet of tube, 7/8" OD by 18 BWG in 30 foot lengths . . . 13,294 individual tubes. The selection of Arsenical Aluminum Brass was made from among the many alloys available from Revere for many specific conditions. Included are the nature of the demands of the service . . . type of water available . . . chemical characteristics of the cooling water.

When you plan to tube a new installation or to re-tube present condensers, feed water heaters, heat exchangers, it will pay you to take advantage of Revere's Technical Advisory Service. For Revere can call upon long experience with alloys, tubing and installation to help you secure longer, more trouble-free service.

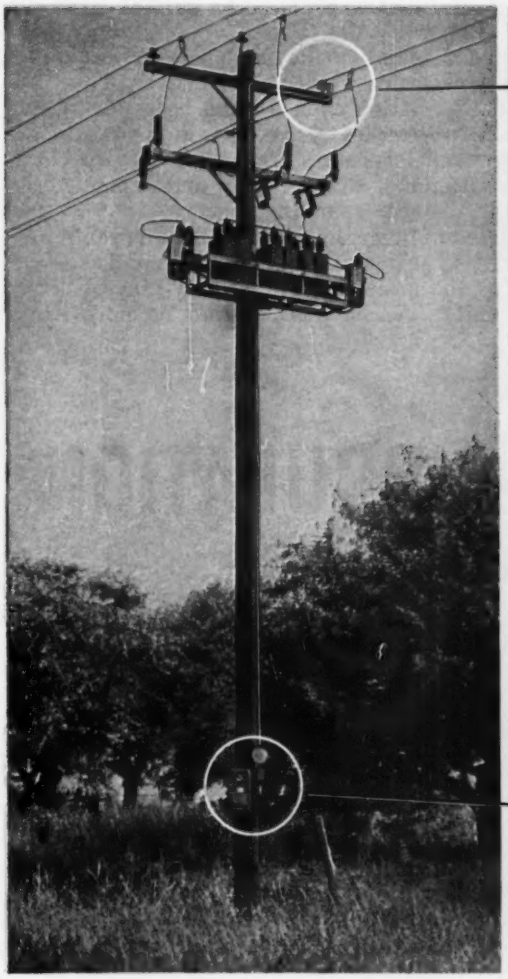
REVERE
COPPER AND BRASS INCORPORATED
Founded by Paul Revere in 1801
Executive Offices: 230 Park Ave., New York 17, N. Y.
Mills: Rome, N.Y.; Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles, Riverside and Santa Ana, Calif.; New Bedford and Plymouth, Mass.; Brooklyn, N.Y.; Newport, Ark.; Ft. Calhoun, Neb. Sales Offices in Principal Cities.
Distributors Everywhere

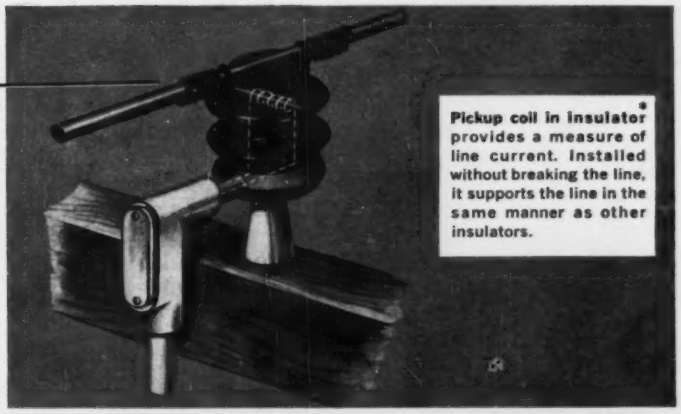
OMEGA FINNED TUBE • BIMETAL TUBE • DUAL GAUGE TUBE • INSTRUMENTATION TUBE • CONDENSER TUBES IN CUPRO-NICKEL, ALUMINUM BRASS, ADMIRALTY, HERCULOY (Silicon-Bronze), ARSENICAL COPPER, MUNTZ METAL AND OTHER ALLOYS • ALUMINUM TUBE, SHEET AND EXTRUSIONS • SMALL AND LARGE PLATES IN CUPRO-NICKEL, COPPER, HERCULOY, MUNTZ METAL, NAVAL BRASS AND ADMIRALTY • LOW CARBON STEEL HEAT EXCHANGER TUBE TO ASTM SPEC. A-214 AND A-334 GRADE "C" • BOILER TUBE TO ASTM SPEC. A-178

ALLIS-CHALMERS

Extended Foil Capacitors

A-1494





Pickup coil in insulator* provides a measure of line current. Installed without breaking the line, it supports the line in the same manner as other insulators.

Current bias shorting* relay is mounted on the side of the control cabinet in a standard watt-hour meter mount. Its operating point can be easily adjusted from rear of the relay mount.

*Designed by the Fisher-Pierce Company

Slash installation time over 50%

with new voltage-sensitive, current-bias capacitor control

Employing an inductive pickup device rather than a current transformer as the signal source, the new Allis-Chalmers voltage-sensitive current-bias control can be installed *in less than half the time* required for existing controls.

By simply replacing the line insulator with the new pickup insulator, you can eliminate the time and effort of de-energizing, dead-ending and cutting into the line required for a conventional current transformer.

This new A-C capacitor control operates on either light or heavy system loads to switch capacitor banks for voltage correction and reactive kilovar supply.

For more facts on capacitor controls to maintain low-loss, high-power-factor system operation, contact your nearby A-C office. **Allis-Chalmers,** Power Equipment Division, Milwaukee 1, Wisconsin.

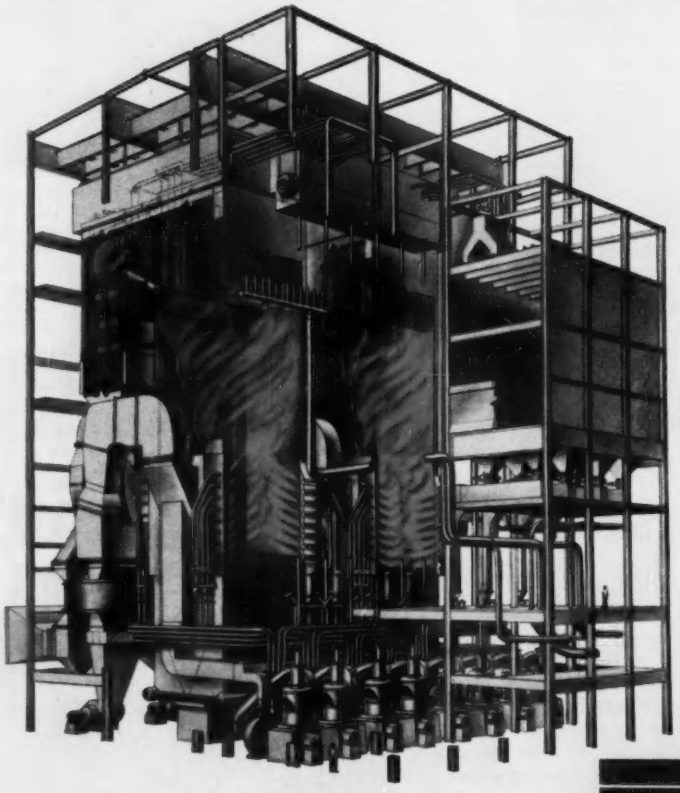
Allis-Chalmers extended foil design capacitors withstand higher inrush currents. Current densities are lower at point of contact between the packs and the contact plates than is possible with conventional tab-type capacitor construction.

In 1950, the C-E Controlled Circulation Steam Generator was made available to the electric utility industry as a fully developed and proven design. Several units were ordered during the year and the first of these was placed in service in November, 1952.

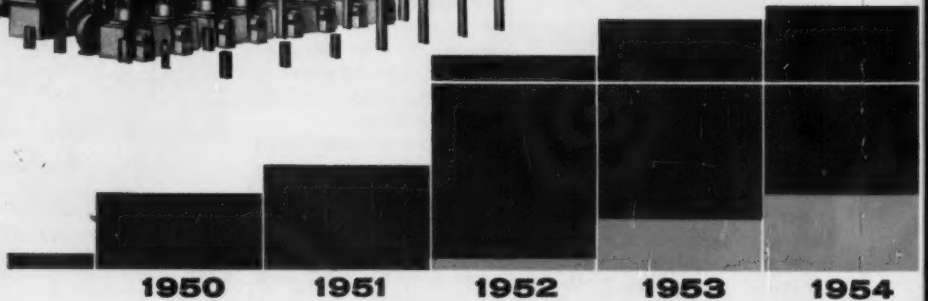
In the intervening decade, the Controlled Circulation Steam Generator has achieved unparalleled acceptance in utility power practice the world over. To date, about 43,000 megawatts of Controlled Circulation capacity has been purchased for utility service at home and abroad. In addition to country-wide installations in the U. S., Controlled Circulation Steam Generators are now in service or under construction in Australia, Canada, England, France, Italy and Japan. Principal statistics are shown opposite and in the accompanying chart.

In the U. S., 37 utility systems have ordered units of this type for installation in 72 power plants located in 22 states. These systems have a total installed thermal capacity equal to more than 50% of the nation's total. Twenty-nine of these systems have ordered more than one unit, seven have ordered six or more and two have ordered twelve or more.

THE CONTROLLED CIRCULATION



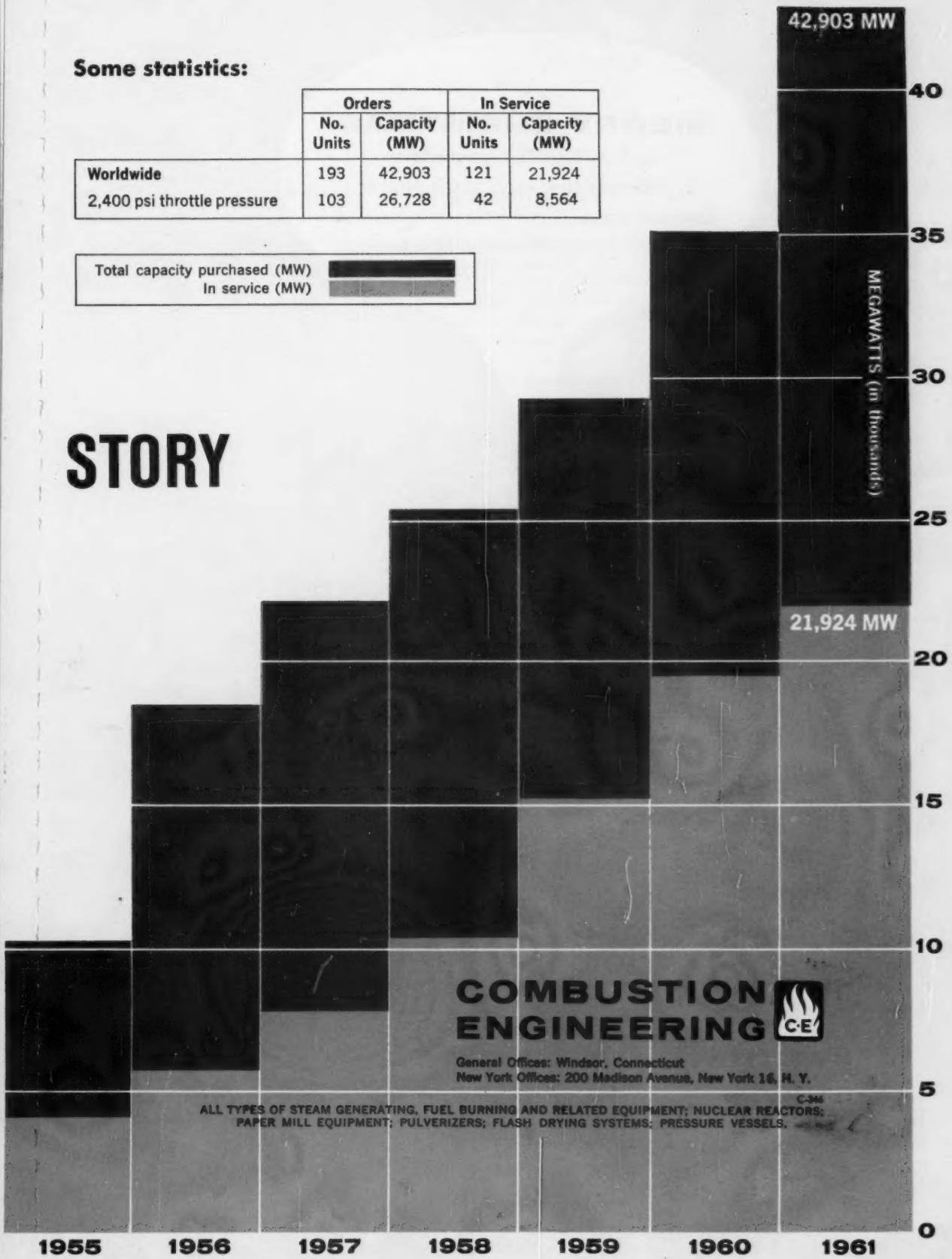
C-E CONTROLLED CIRCULATION STEAM GENERATOR
Controlled Circulation Units like the one pictured have achieved world-wide acceptance in high pressure power practice.



Some statistics:

	Orders		In Service	
	No. Units	Capacity (MW)	No. Units	Capacity (MW)
Worldwide	193	42,903	121	21,924
2,400 psi throttle pressure	103	26,728	42	8,564

STORY

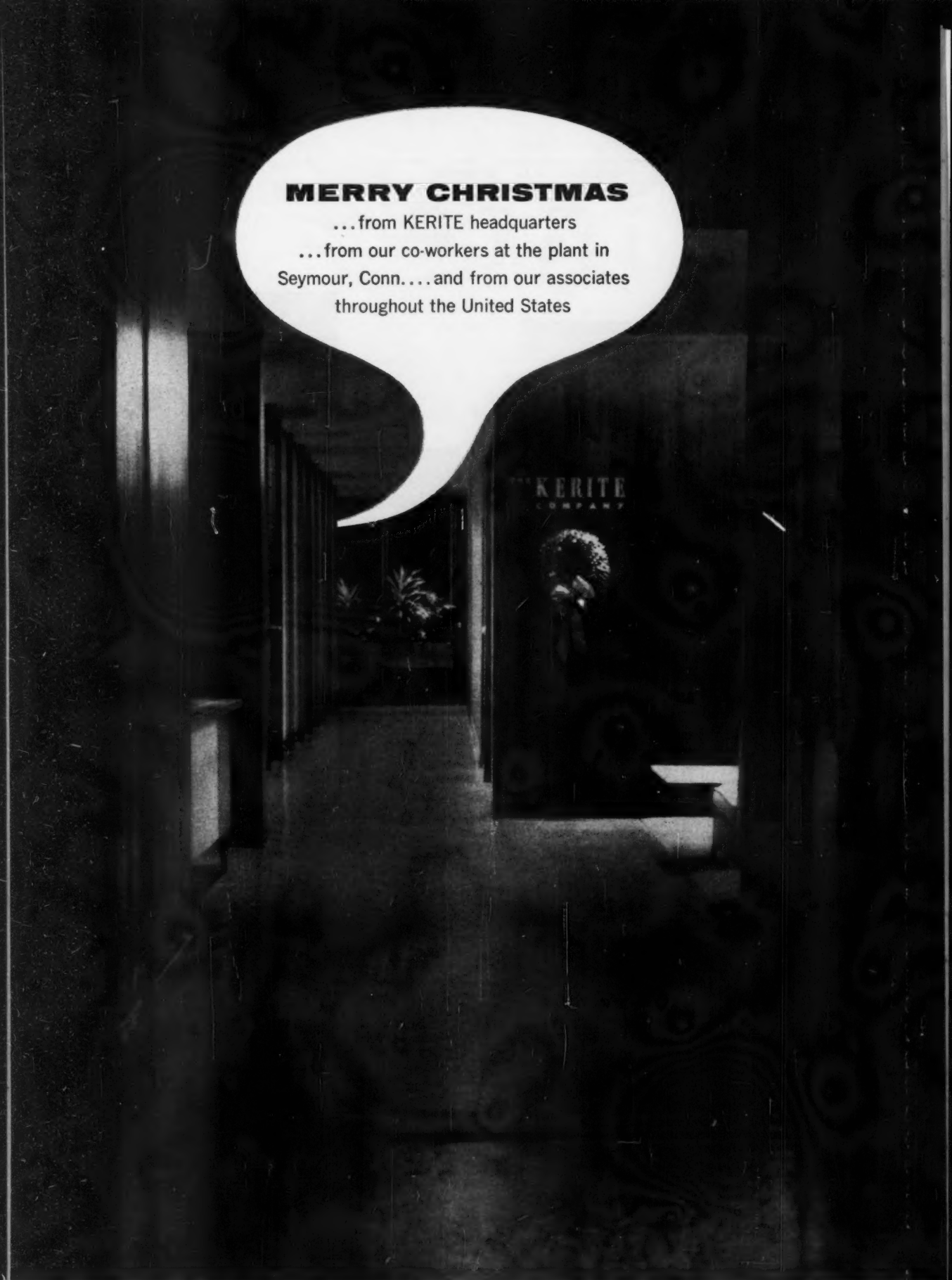


COMBUSTION ENGINEERING

General Offices: Windsor, Connecticut
New York Offices: 200 Madison Avenue, New York 16, N. Y.

C-346

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS.



THE KERITE CO., 30 CHURCH ST., NEW YORK 7, N. Y. DESIGNERS AND MANUFACTURERS OF PREMIUM GRADE INSULATED WIRE AND CABLE, SPLICING TAPE, RUBBER CEMENT. AGENTS IN PRINCIPAL CITIES. A MEMBER OF RAILWAY PROGRESS INSTITUTE.

Editorial Comment

DECEMBER 11, 1961

What Is Federal Role in Interconnections?

The Administration has sketched the broad outlines of its federal power policy.

The picture has emerged gradually, achieving ever-better definition despite conflicts frequently arising between what is said and what is done or formally proposed.

It is clear that the Administration wants a stronger federal hand in the power business. It is even clearer that the Interior Dept, at least, feels the most efficient manner of achieving this is through more and more federal and federally-controlled transmission.

Understanding of what is involved here, as we see it, requires a good grasp of what has gone before, what roles the various government agencies have played under various enabling acts, and what patterns have been set recently. It also requires a feel for the changing semantics in this specialized area.

It is to putting the picture in perspective that we dedicate the Special Report, "What is Federal Role in Interconnections?" in this issue.

We've tried to put together, in one package, a compilation of information which we hope will be genuinely helpful to anyone having a strong interest in this area. We've tried to interpret, to evaluate, to correlate, and in some cases, to suggest slightly different ways of thinking about well-known ideas and approaches.

As responsible citizens, we all share the burden of helping write federal power policy, rather than having it done unilaterally by the executive branch of the government.

We sincerely hope that the Report, by illuminating the underlying issues, aids each power man, whether he is employed by an investor or a non-investor utility, to meet this responsibility.

This Week's Management Newsletter: *Must* Reading

There are two parts to free enterprise: one is competition; the other is profit.

This statement might well be the theme of an article probing the free enterprise system and antitrust law prosecution, published by Leland Hazard in the November *Atlantic Monthly* and condensed in this week's Management Newsletter (p 97).

This, to us, is an immensely appealing article on a subject crying for objective analysis, and we are proud to print it. It lays out some very fundamental truths about the so-called "free enterprise" system in highly intellectual fashion. And, while it reaches no conclusions about precisely how the conflicts it describes can be resolved, it does conclude that the whole subject requires "frank and exhaustive examination."

We certainly agree. Mr. Hazard's comment that "our American philosophy bids us test every dogma by its results—the dogma of competition no less than any other," is irrefutable. And it quickly follows that, "results" being what they have been in recent history, "exhaustive examination" certainly is called for.

We tend to be a bit dubious about the precise mechanism urged by the author for such examination. Once again, intellectually, it would seem that "an economic Kinsey Report" approach, followed by evaluation by "economists, psychologists, sociologists, and people from other relevant professions, having access to all the facts," *should* come up with answers to tell us how to proceed.

Yet *that* approach might seem to be suspect, measured itself by Mr. Hazard's "testing dogma by its results" criterion. The danger is real that any such approach might be exploited by political theorists, with *well-predicted* results.

Still, we regard the Hazard article highly and recommend its careful study.

44 Utilities File Damage Suits

PLAINTIFFS

Atlantic City Electric Co—all 12 suits
Baltimore Gas & Electric Co—all 12 suits
Boston Edison Co—all 12 suits
Central Hudson Gas & Electric Corp—all 12 suits
Central Maine Power Co—all 12 suits
Central Vermont Public Service Corp—all suits except A, B, F, I
The Cincinnati Gas & Electric Co—all 12 suits
The Cleveland Electric Illuminating Co—all 12 suits
Columbus & Southern Ohio Electric Co—all 12 suits
Concord Electric Co—all suits except A, B, I
The Connecticut Light & Power Co—all 12 suits
The Dayton Power & Light Co—all 12 suits
Eastern Utilities Associates[1]
- Blackstone Valley Gas & Electric Co—all suits except A, B, F, I
- Brockton Edison Co—all suits except A, B, I
- Fall River Electric Light Co—all suits except A, B, F, I
- Montaup Electric Co—all suits except F

Exeter & Hampton Electric Co—all suits except A, B, F, I
Fitchburg Gas & Electric Co—all 12 suits
General Public Utilities Corp[1]
- Jersey Central Power & Light Co—all 12 suits
- Metropolitan Edison Co—all 12 suits
- New Jersey Power & Light Co—all 12 suits
- Pennsylvania Electric Co—all 12 suits

The Hartford Electric Light Co—all suits except I
Holyoke Water Power Co—all suits except F
Indianapolis Power & Light Co—all 12 suits
Long Island Lighting Co—all 12 suits
New England Electric System[1]
- Granite State Electric Co—all suits except A, B, C., D, F, I
- Lynn Electric Co—all suits except I
- Massachusetts Electric Co—all suits except I
- Merrimack-Essex Electric Co—all suits except F, I
- The Mystic Power Co—all suits except A, B, D, F, I
- The Narragansett Electric Co—all suits except D, I
- New England Power Co—all suits except F
- Suburban Electric Co—all suits except A, B, F, I

Pennsylvania Power & Light Co—all 12 suits
Public Service Co of New Hampshire—all 12 suits
- Kittery Electric Light Co—all suits except A, B, F, I
- New Hampshire Electric Co—all suits except B, F, I

The Toledo Edison Co—all 12 suits
The Union Light, Heat & Power Co—all suits except A, B, F, I
The United Illuminating Co—all 12 suits
Vermont Electric Power Co, Inc—all suits except A, B, F, I
Virginia Electric & Power Co—all 12 suits
Western Massachusetts Electric Co—all 12 suits

SUITS & DEFENDANTS

A—Turbine-generators: General Electric Co; Westinghouse Electric Corp; Allis-Chalmers Manufacturing Co; (minimum of 96 units ranging in price from $2 million to $10 million apiece)[2]

B—Condensers: Allis-Chalmers; Foster Wheeler Corp; Ingersoll-Rand Co; Westinghouse; C. H. Wheeler Manufacturing Co; Worthington Corp; (minimum of 90 units ranging in price from $100,000 to $1,000,000)[2]

C—Large outdoor circuit breakers: Allis-Chalmers; Federal Pacific Electric Co; General Electric; I-T-E Circuit Breaker Co; Westinghouse; ($4,500,000)[3]

D—Power switchgear assemblies: Allis-Chalmers; Federal Pacific; General Electric; I-T-E; Westinghouse; ($5,500,000)[3]

E—Power transformers: Allis-Chalmers; General Electric; McGraw-Edison Co; Moloney Electric Co; Wagner Electric Corp; Westinghouse; ($13,000,000)[3]

F—Network transformers: Allis-Chalmers; General Electric; McGraw-Edison; Moloney; Wagner; Westinghouse; ($1,700,000)[3]

G—Distribution transformers: Allis-Chalmers; General Electric; Kuhlman Electric Co; McGraw-Edison; Moloney; Wagner; Westinghouse; ($20,000,000)[3]

H—Instrument transformers: Allis-Chalmers; General Electric; Sangamo Electric Co; Westinghouse; ($1,200,000)[3]

I—Isolated phase bus: General Electric; H. K. Porter Co, Inc; I-T-E; Westinghouse; (minimum of 45 units ranging in price from $50,000 to $100,000)[2]

J—Insulators: A. B. Chance Co; General Electric; I-T-E; Lapp Insulator Co, Inc; McGraw-Edison; Ohio Brass Co; The Porcelain Insulator Corp; H. K. Porter; ($2,000,000)[3]

K—Lightning arresters: General Electric; Hubbard & Co; Joslyn Manufacturing & Supply Co; McGraw-Edison; Ohio Brass; H. K. Porter; Westinghouse; ($1,500,000)[3]

L—Meters: General Electric; Sangamo; Westinghouse; ($7,500,000)[3]

[1] Parent companies that are not operating companies and not plaintiffs
[2] Total purchases involved in suit
[3] Average annual dollar volume of plaintiffs' purchases during 1956-60 period

Triple damages sought for purchases back to 1948

A group of 44 investor-owned utilities filed 12 antitrust damage suits in New York last week against 21 electrical manufacturers, seeking triple damages as a result of alleged price fixing (see box, left).

While damages sought were not specified, purchases by the utilities of equipment involved runs into hundreds of millions of dollars.

The 44 companies, some of which are subsidiaries, cover the northeastern states west to Indiana and south to Virginia, and are part of a 150-company group formed earlier this year to study possible damages (EW, Mar. 20, p 25). Some members of this group have already filed suits, either individually or in small groups; presumably the remainder will also file. Last week's group was the largest to date.

The remaining suits are expected before early February, one year after the manufacturers were sentenced in Philadelphia. The statute of limitations, governing filing dates, also allows suits to be filed within four years of the conspiracy.

But in the complaints filed last week, the 44 utilities are claiming damages for purchases back to 1948 under a "fraudulent concealment" charge. The companies contend the conspiracies started as early as 1948 and continued up to varying times last year.

Following filing of the suits, General Electric and Westinghouse, both of which were named in 11 of the actions, reiterated their belief that customers had received fair value and said in their statements they would fight the suits vigorously.

The total number of suits filed so far by utilities, including the government and various public power bodies, now stands at above 150. The total number of plaintiffs involved is also more than 150.

None of these suits has actually gone to trial, and it may be a year before one does. Suits by Philadelphia Electric Co, the City of Philadelphia, and Chelan County PUD, Wash., are said to be in the most advanced stages.

News Scope

- *Public group submits Hanford proposal to AEC and BPA*
- *Udall throws weight behind Marble Canyon delay request*
- *Two reactors encounter technical troubles*
- *Dominy hints at extending Reclamation's service area*
- *Revised National Electric Safety Code available*

● **A proposal to build and operate power production facilities at Hanford NPR has been submitted** by Washington Public Power Supply System to the Atomic Energy Commission and Bonneville Power Administration. Conferences among the three agencies have previously been held, and WPPSS wants to start negotiations.

In the proposal, WPPSS would finance, construct, and operate the NPR generation facilities. The AEC would make both the site and steam available to WPPSS during the eight-year period of dual-purpose operation of the reactor. Thereafter, the AEC would lease the facilities to WPPSS. BPA would purchase the power, integrating it with federal resources and reimbursing WPPSS for its cost in payments for power received.

The proposal also provides for acquisition by the government, at its option, of the electrical generating and associated facilities—either by payment during the life of the contract, or without cost when all bonds or other obligations incurred by WPPSS have been retired.

● **Interior Secretary Stewart Udall throws his weight behind a request to delay FPC proceedings on the Marble Canyon project.** In a letter to Arizona Gov Paul Fannin, Udall said the US Supreme Court should first rule on the long-standing Arizona-California water rights case, and Reclamation should then have time to complete a broad study of water needs in the region in the light of the Court's ruling. Assistant Interior Secretary Kenneth Holum had previously requested FPC Chairman Joseph Swidler for the delay (EW, Nov. 13, p 46).

● **Two nearly completed nuclear power reactors are encountering technical troubles.** At Hallam, Neb., electronic noises are making problems in the 75-Mw sodium graphite reactor's start-up controls and in-core neutron monitoring systems. All the errant beeps and bloops must be eliminated before scheduled fuel loading this month is allowed. Assuming this is done, Consumers Public Power District expects the reactor to go into operation early next year.

At Lagoona Beach, Mich., the AEC has allowed Power Reactor Development Co to amend its construction permit and postpone until Sept. 1, 1962 construction completion of the 100-Mw Fermi fast-breeder power reactor. Carbon shielding blocks did not stand up under high temperatures—up to 1,000F—during non-nuclear preliminary tests this summer. Some of them decomposed, deformed, and experienced carbon growth. As a result, some six months will be required to replace the shielding material.

● **Reclamation Commissioner Floyd Dominy didn't say yes and he didn't say no,** but he did raise the possibility of extending the limits of the Bureau's operations beyond the 17 western states.

In a speech before a natural resources seminar at Ohio State University, Dominy said, "Heretofore, this (water resource development) challenge has existed primarily in the West. The people in the humid zones of our nation have been spared the expense and trouble associated with making a limited water supply serve their ends. There are signs, however, that your days of plenty are approaching an end. Perhaps this very seminar could be interpreted as just such a sign.

"The Bureau of Reclamation, from time to time, receives inquiries concerning extension of our services beyond the West. We have no inclination toward that governmental disease known as 'empire building,' but we are finding our services, know-how, and the resources of our technical organization in Denver are increasingly in demand."

● **A Revision of Part 2 of the National Electric Safety Code is now available.** Titled *Safety Rules for the Installation and Maintenance of Electric Supply and Communication Lines,* National Bureau of Standards Handbook 81, it is available from the Superintendent of Documents, US Government Printing Office, Washington 25, D.C. Price: $1.75.

Florida Utilities Form Operating Group

Four-system operating committee to plan jointly; increased savings and greater reliability expected from pooling

Three major Florida investor-owned power companies—Florida Power & Light Co, Florida Power Corp and Tampa Electric Co—have joined forces with the Orlando Utilities Commission to form a Florida Operating Committee to provide for joint planning and operation of the four systems. Spokesmen expect great savings and increased reliability to result from the pooling arrangement.

The group's program calls for strengthening transmission ties between systems, as well as those within the operating areas of the individual companies.

Until just about a year ago, maximum transmission voltages in Florida were in the range of 115 and 138 kv. Now one line placed in operation last year extends from Ranch, near Lake Worth, north and parallel with the Atlantic Coast to Brevard, a distance of 120 miles, and then another 50 miles northwest to Sanford.

Now under construction is a line across the Everglades from Ranch to Fort Myers, which will extend northwest to Sarasota. It will also operate at 230 kv.

A transmission line under construction through the north central part of the state, from Silver Springs to Fort White, a distance of 75 miles, was designed for 230 kv. This new line, however, will be operated initially at a voltage of 110 kv.

Other transmission lines scheduled for the next two to three years include:

1. A 230-kv line which would tie the four-system grid to the city of Jacksonville with a line from St. Augustine.
2. Extend from the Suwannee Steam Plant of Florida Power Corp, in the north central section of the state, south and west to St. Marks on the Gulf Coast and on southwest to Port St. Joe. Scheduled for 1964, this line would also be 230 kv.
3. A 230-kv line which would tie Daytona Beach to Sanford.
4. Additional transmission lines to the Cape Canaveral-Cocoa Beach area.

With the strengthening of the Florida systems, it is anticipated that interconnections with Georgia Power Co and Gulf Power Co to the north and to the west will also be increased. This will permit the interchange of power in larger blocks and more freely than has been the case in the past.

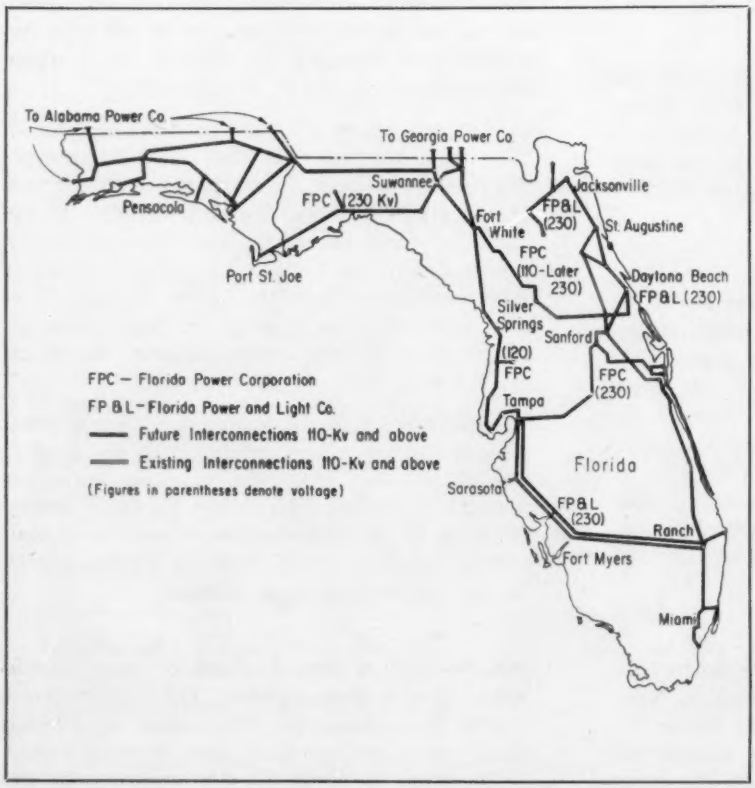
The transmission grid now in the making in Florida, plus the coordinated planning of new generating facilities, will permit the staggering of new generating unit schedules between the four systems—Florida Power & Light, Florida Power Corp, Tampa Electric and the Orlando Utilities Commission.

Substantial construction economies, through the building of larger units, and operating economies, from the coordinated operation as a single system, are expected to be realized quickly.

Maintenance Scheduling Eased

Harry Page, a representative on the Florida Operating Committee, explains, "We are able to gain system security by working together in planning maintenance work on major generating equipment. In scheduling plant overhauls, for instance, we can avoid having our biggest units out of service at the same time. Also, we can save money by sharing the spinning reserve we carry for emergencies.

"The committee has already made broad studies on the interconnected system, projecting it for 1970. This gives us a long-range goal. Now we are making studies for 1964, which will provide us with an intermediate step."



TRANSMISSION INTERCONNECTIONS planned or under construction will tie four systems closer together. Strengthened ties to other utilities are likely

AEP, Illinois Power Announce 345-Kv Tie

A 32-mile line will be first direct tie between systems though both belong to the Interconnected Systems Group

Illinois Power Co and the American Electric Power System have announced plans for constructing a 345-kv interconnection between their systems. The 32-mile line, expected to cost $4 million, is scheduled to go into operation in June, 1963.

The tie will connect existing transmission facilities of the two systems and will extend from a substation to be built near Sidney, Ill., by Illinois Power Co, to a substation to be built by Indiana & Michigan Electric Co near Cayuga, Ind. The latter utility is one of six operating electric companies making up the AEP System.

Capacity of the single-circuit tie will be 300 Mw. Provision has been made in the design for a second circuit when it is required.

The new interconnection will be the first direct tie between the two companies. They are now interconnected on an indirect basis through the Interconnected Systems Group, consisting of 100 companies operating in 32 states with a combined load of 64 million kw.

50-Year Agreement Signed

The 50-year interconnection agreement calling for construction and operation of the line was executed by Allen Van Wyck, president of Illinois Power Co, and Philip Sporn, president of both I&M and its parent, AEP. They described the interconnection as "a tangible demonstration of the investor-owned power industry's ability and willingness to carry out the joint planning, construction and operation of integrated power systems capable of supporting large generating units and of providing the most economical service."

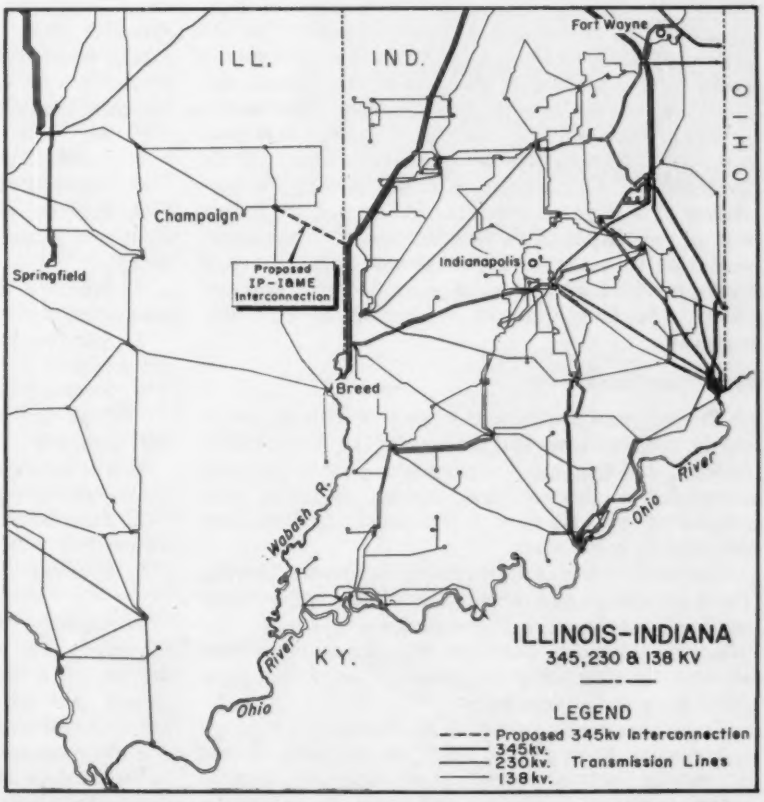
Van Wyck and Sporn pointed out that the interconnection was the result of a year's careful and painstaking study to determine its potential benefits and economic support. "This is the basis on which all of the nation's major interconnected systems have been developed," they commented, "and it is the only procedure that can lead to any truly sound and rational system of regional interconnected grids extending across the nation."

They emphasized that the benefits to accrue from the interconnection would be of major importance not only to the respective companies and their customers, because of the substantial operating economies that will be realized, but also to the respective regional power systems of which each is a part. These are the Illinois-Missouri pool, of which Illinois Power is one of three members, and the six-company, seven-state AEP System, part of the N. Central Area Interconnected Group.

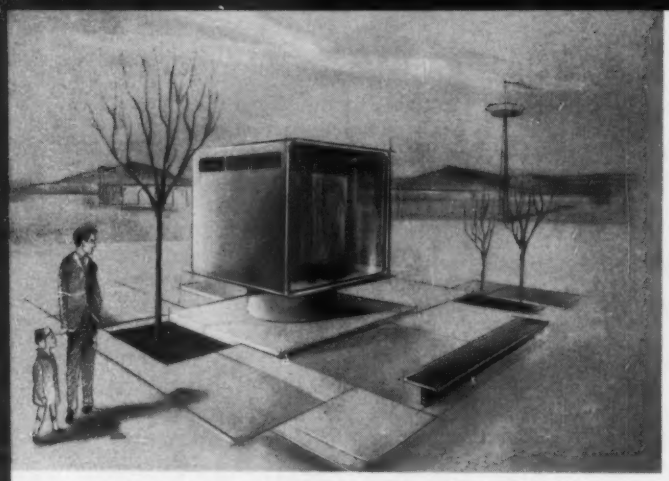
The interconnection will make possible the exchange of power for both economy and emergency purposes and for coordination of power plant maintenance schedules. In addition the tie will permit both systems to operate with less generating reserve.

Most (30 miles) of the line's length will lie in Illinois and will be constructed by Illinois Power; the remainder will be in Indiana and will be built by I&M. At its western end near Sidney, the line will tie to an existing 138-kv loop. At the eastern end, it will tie to the double-circuit 345-kv line connecting I&M's Breed Plant to a service area near South Bend.

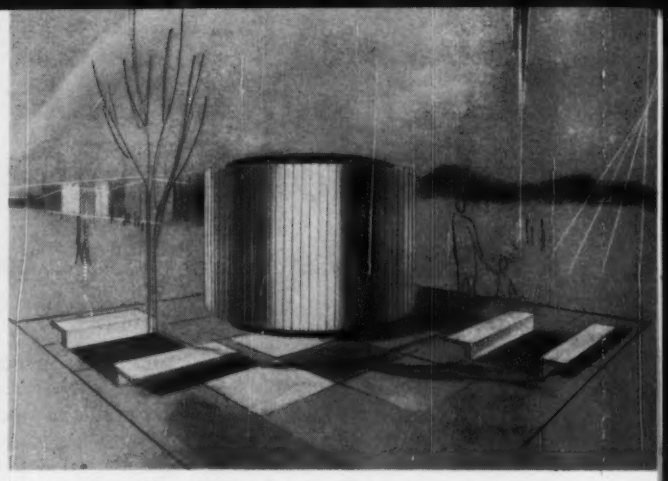
At present, the AEP System is directly interconnected at voltages ranging from 138 to 345 kv with 18 other utilities at 38 different locations around the periphery of its service area. Illinois Power Co is directly interconnected with six adjoining utilities at 15 locations around its system.



MOST OF THE 345-KV LINE (30 miles) lies in Illinois and will be built by Illinois Power Co. Over-all cost of the line is expected to be about $4 million



FAIRS AND EXHIBITIONS are suitable places for transformer enclosures with plastic windows for viewing insides



PARKS AND MUSEUMS can be supplied from power apparatus in enclosures designed to blend with area's features

Utilities Responding to Demand

But need standardized equipment to warrant cost of new home areas' esthetic demands

R. J. LANG, Engineer, Underground Systems, Line Material Industries, McGraw-Edison Co, Milwaukee, Wisc.

Sentiment outside, but expressed privately to the electrical industry, leans increasingly to underground distribution in residential areas. This is a natural outgrowth of demands for better-looking neighborhoods.

One prediction of the author's company is that most new distribution systems in the near future will be underground. This prediction is bolstered by the prediction of a large metropolitan utility that its system will go underground within ten years. A second prediction is that much apparatus will be taken out of vaults or off poles and placed on ground-level concrete pads. The latter forecast is spurred by economic necessity.

Economies Underway

The two main components in an underground system are the cable-trenches and the housings of transformers, switches, and terminals. Attempts to provide the most economical method of designing and installing each component are underway. This article explores only the housing component.

Two major methods now provide equipment housing. These are special pad-mount transformers and surface-mounted enclosures for conventional overhead distribution equipment. Both have advantages, but neither achieves the ultimate goal—housings for underground distribution at the lowest cost.

Transformer enclosures have their primary advantage in flexibility. Thus, specific utility requirements are met by varying internal mounting arrangements without changing over-all dimensions and hence the cost of the basic enclosure. But the requirements of adequate ventilation and tamperproof construction prevent transformer enclosures from being lowest in cost.

Primary advantages of pad-mount transformers are compact size and use of transformer walls exposed to the atmosphere for more effective cooling. Such cooling eliminates tamperproof venting.

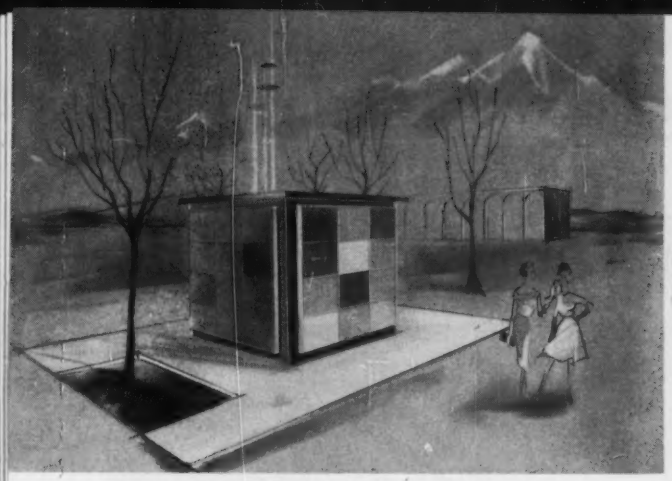
Hundreds of pad-mount transformer designs are offered by manufacturers. Such supply leads only to excessive cost. Standardization of pad-mount transformer requirements must be met before the best economics can be realized. To achieve this goal, manufacturers should focus on these areas:

1. Standard pad configurations
2. Standard bushing location.
3. Interchangeability of cable termination compartment and transformer sections among manufacturers' designs
4. Standard range of transformer sizes with given compartment sizes
5. Standard location of primary and secondary cabinet sections
6. Standard color and gloss.

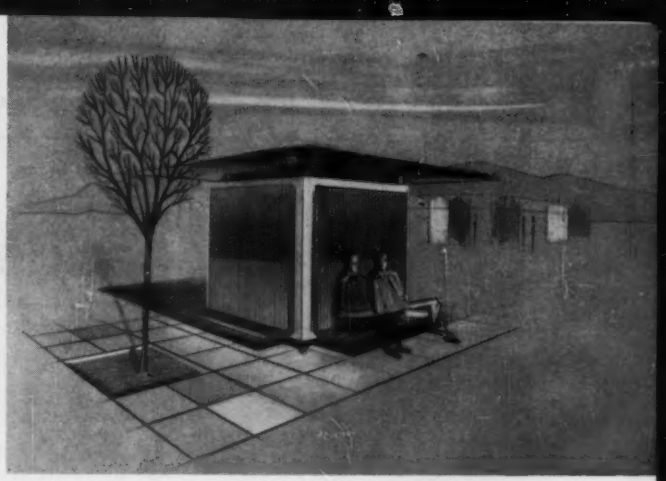
Utilities can contribute greatly toward standardization if they will:

1. Fix realistic specifications for adequate sectionalizing and fusing methods.
2. Establish requirements for the range of transformer kva to be accommodated by one compartment.
3. Establish minimum space for cable terminations.

Fortunately, utilities and manufacturers recognize the importance of standardization to achieve ultimate low cost to consumers and themselves. EEI-NEMA groups have taken an active interest which has eased the situation and brought about some gains. An encouraging degree of standardization has been achieved in the location of primary and secondary bushings. A nationally accepted unit with the high and low-voltage compartment on one side of the transformer has emerged.



ENCLOSURE set in industrial park meets requirements of ordinances regarding uncluttered suburban appearance



SURFACE-MOUNTED ENCLOSURES fit in with shopping center or among the high-rise downtown commercial buildings

for Underground Distribution

Utilities, which cannot accept the final standardized designs, can meet their own requirements most economically through use of standard enclosures. When the problem of standardization is solved, most residential underground distribution systems will be served by pad-mount transformers.

The future of enclosures appears to be principally in areas other than residential distribution. Not long after the first enclosures appeared, distribution engineers and architects realized that housing transformers was only one of many applications. Equipment that these standard housings can enclose are capacitors, automatic load transfer equipment, power and control centers for street and highway lighting, manual cable sectionalizing centers, and emergency mobile transformers for residential loads. In these applications major economic advantages are achieved over present methods through standardization.

PAD-MOUNTED TRANSFORMER requires standardization of pad shape, bushing location, interchangeability of parts, etc

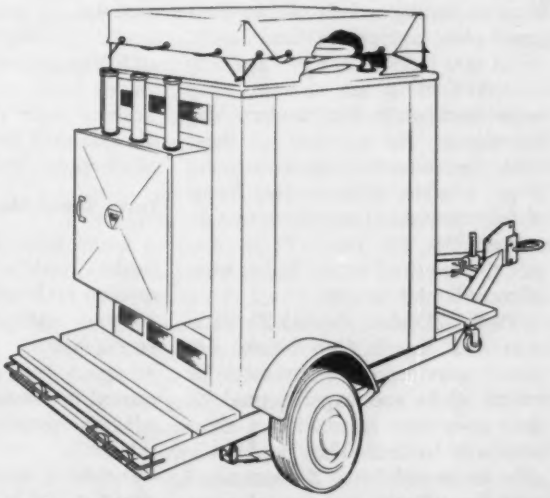
Architects Saw Potential Savings

Architects recognized the potential savings in substituting enclosures for indoor or outdoor vaults. Enclosures now house transformers supplying schools, hospitals, shopping centers, and new industrial installations. Substantial savings are evident in all areas.

But widespread use has been curtailed somewhat by the appearance of the enclosures, especially at shopping centers where they are seen by the public. Eye-pleasing designs are needed to meet architectural requirements.

To show how this can be done, architects were asked by the author's company for their ideas. Illustrated are concepts of enclosures that are not only pleasing in appearance but meet most requirements for housing such apparatus.

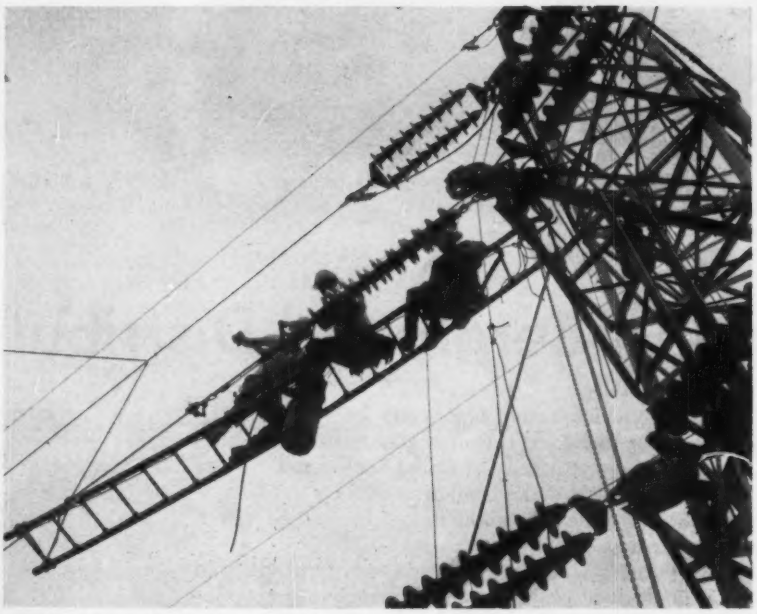
The enclosure concept allows the greatest flexibility in arrangement of apparatus, and the external housing can be modified economically to meet specific architectural requirements. Modern designs will find increasing use where the appearance features can be justified economically and functionally.



STANDARDIZED ENCLOSURE can be adaptable to mobile operation, good appearance without sacrificing economy

Epoxy Hook Ladders Adopted

ROBERT J. FOX, Manager, Safety Dept, Philadelphia Electric Co, Philadelphia, Pa.



EPOXY RESIN LADDER has been enthusiastically acclaimed by crews. Tests have also shown merits in dielectric strength, physical strength and weight

An epoxy resin ladder has been recommended at Philadelphia Electric Co as standard equipment for transmission-tower work. After an 18-month study, which included the testing of about 75 ladders of various materials and constructions, the company's hook-ladder committee recommended this type ladder with the company's own method for bonding rungs and hooks to side rails.

Early in 1959, although no personal injuries resulted, two instances of wood-ladder side-rail failures indicated the immediate need to review hook-ladder standards. Subsequently, a hook-ladder committee was originated with members from the safety, electric T&D and engineering departments and the maintenance division. This committee was charged with determining whether the ladders in use were adequate under existing working conditions and charged also with conducting the study.

For the first responsibility, the committee found that total weight on the ladder under normal conditions to be the weight of two linemen plus equipment and tools, about 600 lb. Testing of light-duty ladders then in use revealed they were inadequate for modern day techniques. As a result of these tests, the committee decided to try to get a ladder with a safety factor of four and asked suppliers to submit samples for tests. Those that met the required safety factor were of considerable weight.

Two T&D men, Gerald Zimmerman and Joseph Van Name, obtained some epoxy resin used for switch sticks and experimented on their own time in making a short section of ladder. They used available tools and Mrs. Zimmerman's oven for adhesive bonding of rungs to side rails. They submitted this section of ladder to the committee, which authorized the maintenance division to construct a 10-ft section for tests and asked the A. B. Chance Co, which had supplied the epoxy material, to assist in development. Under the direction of Zimmerman and Van Name, the manufacturer made three experimental ladders. Tests of them showed that 2½-in.-dia side rails and 1¼-in.-dia rungs, all of epoxy, had definite promise.

Tests Show Merits

Later, tests of three more sample ladders with certain modifications showed favorable results:

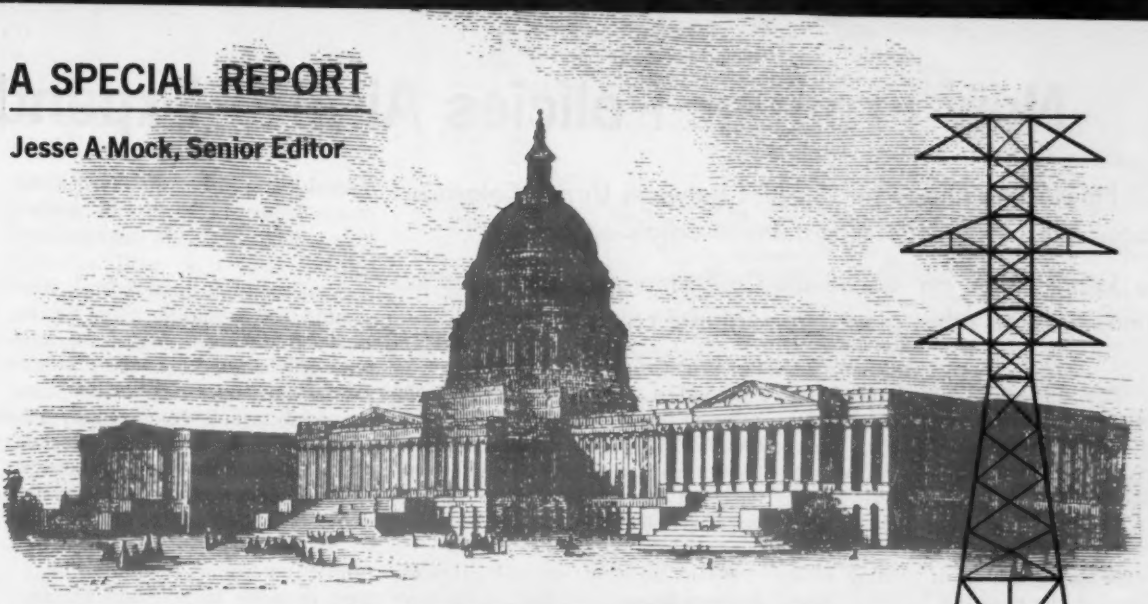
- 4-to-1 safety factor had been established.
- Impact test of 200,000 strokes caused no damage or failure of the adhesive securing the rungs to the side rails.
- Dielectric strength of epoxy resin tested at 100 kv.
- The ladder had definite advantages under adverse weather conditions.
- The ladder was light in weight and easy to handle.
- Strength of the ladder indicated it would be less susceptible to damage in normal use than wood ladders.
- All crews enthusiastically acclaimed its superiority after a three-month field test.

With more than 7,000 ladders, including hook ladders, Philadelphia Electric Co's ladder program consists in rigid purchasing specifications and acceptance tests, followed by periodic inspection of each and every ladder, as well as training classes on the proper use and care of ladders.

When initiated in 1951, this program covered wood hook ladders for transmission construction and maintenance. This type had been in use since 1924 and had proved adequate for many years. Since the ladder program started, the number of hook ladders had increased from 30 in 1951 to 120 in 1959.

A SPECIAL REPORT

Jesse A Mock, Senior Editor



What Is FEDERAL ROLE In INTERCONNECTIONS?

Advent of the Kennedy Administration has brought a major emphasis on electrical interconnection proposals. This represents a shift in federal power policy which previously had dealt mainly with construction of hydroelectric projects and transmission marketing lines.

Beneath the economic and technical aspects of proposed federal interconnections are the hard political issues and the more fundamental issues of national policy.

These issues are too significant to remain the sole province of the engineer and the economist, the utility executive and the government official.

They need to be studied and understood by the citizen and his elected representatives in Washington.

It is with this in mind that we present this report.

The federal government has an established role in the interconnection of the electrical systems.

Through its regulatory powers it is authorized to promote and encourage both the coordination and interconnection of systems to assure an abundant supply of electric energy at reasonable rates.

The Kennedy Administration has announced its intention of entering upon a second and much broader role in the interconnections field.

It proposes that the federal government undertake to build heavy interconnections between existing federal systems and connect with other major systems along the paths of these lines.

This role is less well established and less widely accepted.

The primary purpose of this report is to examine and analyze this broader federal role in interties.

To do this it is necessary to determine where the Administration is headed. For perspective, we need to have some idea of existing and planned interconnection and pooling arrangements. From these we turn to such fundamental questions as: By what authority does the government act? Who has the responsibility for initiating interconnections? What happens to preference? What does "common carrier" mean? There are a host of such questions.

From this report, it is possible to conclude:

1. The Kennedy Administration is already engaged in studies looking toward giant interconnection of federal systems and has indicated an intent to greatly enlarge such studies. Congress has already approved funds for initiating some interties.

2. Some 90% of the nation's power capacity is tied in with one or more of the existing interconnections or power pools and investor utilities have published plans to greatly strengthen and further coordinate these into a grid that spans the nation.

3. There is probably constitutional and legislative precedent for a broader federal role, but Congress still holds the purse strings.

4. Responsibility for initiating interconnections lies with utilities which stand to benefit, but government regulatory bodies are authorized to promote and encourage interconnections.

5. Taxpayers would bear a part of the cost of federal interconnections.

6. The term "common carrier", as applied to electric transmission has not been defined.

7. Federal giant interties would tend to enlarge government control of the nation's power supply.

New Frontier Policies Aim to Expand

- **Plans move ahead for interties between Upper Colorado basin and other federal systems in adjoining areas**
- **Report due on Bonneville-California tie, and studies underway on other giant interregional connections**

Transmission interconnections, regional interties, backbone grids, giant power—these phrases (see page 72) are a dime a dozen in Washington.

There's work being done to give meaning to them in the new administration—some of it coming to a head in the next few months. Also speculation continues on other references to big transmission lines that were made by power advisers to the new administration during the 1960 campaign and afterward.

Chances are that in the months ahead the executive branch will study and push for development of big, regional transmission ties—possibly with a "common carrier" tag—while an election-minded congress will attempt to hold down the lid on much of this program. The Federal Power Commission, a Congressional power agency, may be caught in the middle.

Congress Approves Studies

Congress this year approved, with minor dissent, a Reclamation Bureau study for at least three-interregionnal federal tie lines. But Congress over the years has shown reluctance to support lines where questionable feasibility, adequacy, or possible duplication of existing facilities exists.

Definite actions by the Kennedy Administration on big power lines include these:

- The Bureau of Reclamation is going ahead with plans to build a federal grid for the Upper Colorado Project—after a close battle in Congress—connecting the project's generation with major area load centers and other federal regional systems: Hoover-Parker-Davis, Missouri Basin, and possibly the Rio Grande.

- The Bureau, similarly, is moving ahead with newly-won authority to build a federal interconnection between the Trinity power dam and the Central Valley Project in California. Part of this new line may be designed for conversion to higher voltage (500 kv).

- The study of regional interties between federal systems is underway at the Interior Department. Congress voted $300,000 for this study this year, and probably will vote a similar amount next year.

- The Federal Power Commission soon may announce plans for an investigation of plans of the nation's non-federal systems to build transmission interconnections. The study, a probability anyway, was spurred by the recent announcement of the Edison Electric Institute that U. S. power companies would spend about $8-billion during the coming decade for new transmission lines (EW, Sept. 11, p 44). FPC's concern would be whether the lines are built in the national interest with regard to location, standard voltages, capacities, and economics.

- An Interior Department "Task Force" will report about mid-December on the feasibility of a major intertie (345 kv or higher) between California and the Bonneville Power Administration. This report may be the kick-off in a drive to build a federal intertie. Thorny problems to be answered include the engineering and financial feasibility of the line, as well as giving the Pacific Northwest some sort of area "protection" in case needed Bonneville power is exported from the area during critical years.

Congress could get the Bonneville-California "hot potato" early next session, with its attendent problem of writing acceptable regional "protection", or "double preference", provision in law so that the federal line won't syphon off federal power from old Northwest preference customers to new ones in California.

Availability of non-federal connecting lines within the three Pacific Coast states might halt proposals for a federal line—at least it would slow them down. A smaller line, proposed several years ago by Pacific Gas & Electric, was blocked by the Senate Interior Committee as an inadequate connection, skimming off the "cream" of any benefits for another interties. But, a major connection from the Columbia mainstem capacity to Southern California, would be difficult for Congress to criticize. Furthermore, Congress might find such a non-federal line an easy "out" to the trickey regional preference problem.

Other intertie plans include the sweep of federal systems.

Holum Asks More Studies

Assistant Interior Secretary (Power) Kenneth Holum has told a number of regional meetings of the National Rural Electric Co-op Assn. that "potentially valuable interconnections exist between Southwestern Power Administration and Reclamation's Missouri Basin System, between Southwestern Power Administration and the Tennessee Valley Authority (with substantially different load characteristics), and between Southwestern Power Administration and Southeastern Power Administration. Decision as to which studies shall be made will be decided following the final assembly of load and resource data by the marketing agencies."

Holum also suggests expanding SWPA's own lines: "We want a Southwestern Power Administration system, and we expect to market power from that system." Incidentally, both Commissioner Dominy and SWPA Administrator Douglas Wright have praised the private wheeling arrangements in SWP's territory as a model for the country.

Wright told a House Appropriations Subcommittee this year that he has favored a study of a "large, inter-regional transmission tie, without regard to ownership . . . which would connect Denison Dam

Federal Role

(SWPA) with Tenkiller Ferry Dam (SWPA), Springfield, Mo., Kansas City and Omaha, and would connect Tenkiller Dam with Little Rock, TVA. . . ." He added, however, that a number of midwestern utilities were planning a major grid for that section of the U. S., and "you will notice that they had exactly the same idea I had." Wright also claimed that pumped storage potential in his area (750 mw at Tenkiller) still would be sufficient to "justify one (federal) circuit and to pay for it."

Grid to Save Millions

Wright said the investor-utility grid "will save two years' generation installation, which would amount to $300 million. . . . It will not only affect my system favorably, but will enable the government to meet its responsibilities in . . . pump storage . . . and will place in this . . . system the greatest integrated power system in the U. S. . . . When you save the installation of two years' generation by tying these things together, you have achieved 10% over-all efficiency increase in the area of power utilization."

There is talk of an FPC investigation of major utility transmission needs and plans. FPC Chairman Joseph Swidler feels strongly that coordination of such planning—on the scale announced by EEI—is needed, and his commission is the logical agency to make such a study.

An indication of the Commission's plans may come in the President's January budget message. It would be in the form of a request for additional funds to increase the FPC power staff.

Underneath these Administration plans lies federal power attitudes of advisers to the Democratic party. These advocates managed to get their views incorporated into campaign documents and both party and administration policies. President Kennedy has shown a willingness to accept many of these policies at face value until he has time to study them. But, it still isn't clear just how far the President is willing to go toward incorporating these views into a firm federal transmission program.

Finally, I have directed the Secretary of the Interior to develop plans for the early interconnection of areas served by that Department's marketing agencies with adequate common carrier transmission lines; to plan for further national cooperative pooling of electric power, both public and private; and to enlarge such pooling as now exists.

—President Kennedy
Message to Congress, Feb. 23, 1961

The Department of the Interior, in cooperation with other agencies, must re-assert its responsibility to provide long-range planning of generation and transmission facilities to meet future needs, with immediate attention to the economic necessity of interregional federal transmission ties.

—Kennedy-Johnson Resources Advisory Report
Jan. 17, 1961

...We are going to encourage additional REA-financed generation and transmission facilities wherever necessary to secure an abundance of power for growing rural needs at the lowest possible rates...

--John A. Baker, director of Agricultural Credit Services
Before NRECA Convention, Feb. 14, 1961

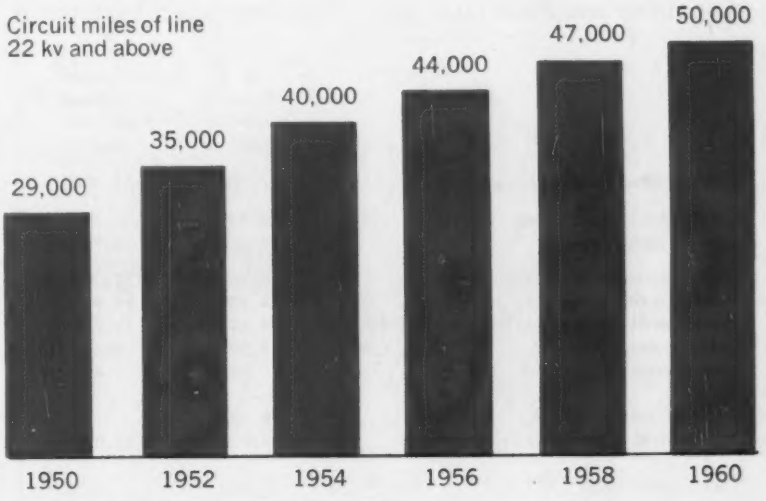
Mr. MAGNUSON: Ideally we should hook together all of North America.
DOMINY: Actually that may not be too fantastic.

Remark of Reclamation Commissioner Floyd Dominy
At House Public Works Appropriation Hearing
May, 1961

In this area potentially valuable interconnection exist between Southwestern Power Administration and Reclamation's Missouri Basin system, Southwestern Power Administration and the Tennessee Valley Authority with substantially different load characteristics and between Southwestern Power Administration and Southeastern Power Administration. Decision as to which studies shall be made will be decided following the final assembly of load and resource data by the marketing agencies.

Asst Interior Secretary Kenneth Holum
Before NRECA Regional Meeting
Nov. 3, 1961

Growth of Government Transmission Lines (federal, state, local)



Based on data from Edison Electric Institute

US Power Network Is on the Way

- **Completion of nation-wide high-voltage grid by 1970 will permit interconnected operation of all U S power systems**
- **Over 90% of 1960 generating capacity is already part of one or more regional interconnected system groups**
- **Plans have been drawn for tying together present interconnected system groups or "pooling the pools"**

Today in the United States the finishing touches are being added to a vast national network of high-voltage transmission lines. Even now an approximation of such a national network is in existence among the power systems of 32 states east of the Rocky Mountains. And other networks have been operating for years west of the Rockies. By the end of the 60's plans now already published will permit all the major power systems of the nation to operate on an interconnected basis from coast to coast.

As the accompanying table and map shows, more than 90% of the generating capacity of the US today is part of one or more regional transmission networks or interconnected systems, as they are called, that blanket the country. There are over 20 of these regional networks. They have been built up progressively over the years as the use of electricity in the country doubled and redoubled. Individual power companies tied their transmission systems together so they could support each other in emergencies, plan the removal of their facilities for maintenance without jeopardizing service, and use limited power plant sites to best advantage by installing bigger, more economical units. Also by tying together it was possible for the interconnected systems to conserve the amount of generating capacity held in reserve for unexpected accidents on individual systems, and to take advantages of different load characteristics and costs of fuel within regions.

The coordination of operations among members within a regional interconnected group of systems varies from a highly informal day-to-day barter to a highly sophisticated contractural arrangement. Generally speaking the more sophisticated contractural groupings are called power pools. In other words, all power pools are interconnected systems, but not all interconnected systems are pools.

All that remains for the completion of a national power network or "giant grid", as some like to call it, is the strengthening of interties between and within today's already existing regional networks; a "pooling of the pools", so to speak.

The planning steps necessary to bring this about have already been taken. In mid-September, this year, a Transmission Task Force of the Edison Electric Institute, acting in cooperation with the investor-owned utilities, whose systems make up the bulk of the existing regional interconnected systems, announced a coordinated program to build an estimated 100,000 miles by 1970 at a cost of $8 billion so that a national power network might be possible. The location and extent of these transmission lines was shown on a map (EW Sept 11, 1961, p 42) prepared by the EEI.

This EEI map of present and projected transmission lines was coordinated with a revised map of US interconnected systems, first published by *Electrical World* Nov. 9, 1959, to produce the accompanying map showing proposed interconnections between existing regional interconnected systems necessary to create a complete national power system network by 1970. Details of some of the lines are still subject to the findings of studies; others, shown dotted, are yet to be confirmed.

As this program advances, the number of interconnected systems will decrease. Their size and capacity will increase, however, until one interconnected system covers the entire country. However, for operating purposes the national network will be composed of several relatively large regional interconnected groups. At present there are six such major regional interconnected groups.

These are: **1.** The Interconnected Systems Group, **2.** The Pennsylvania-New Jersey-Maryland Interconnection, **3.** The Canadian-US Eastern Interconnection, **4.** The Northwest Power Pool and Interconnected Systems, **5.** The Pacific-Southwest Interconnected Systems Group, and **6.** The Texas Systems Group.

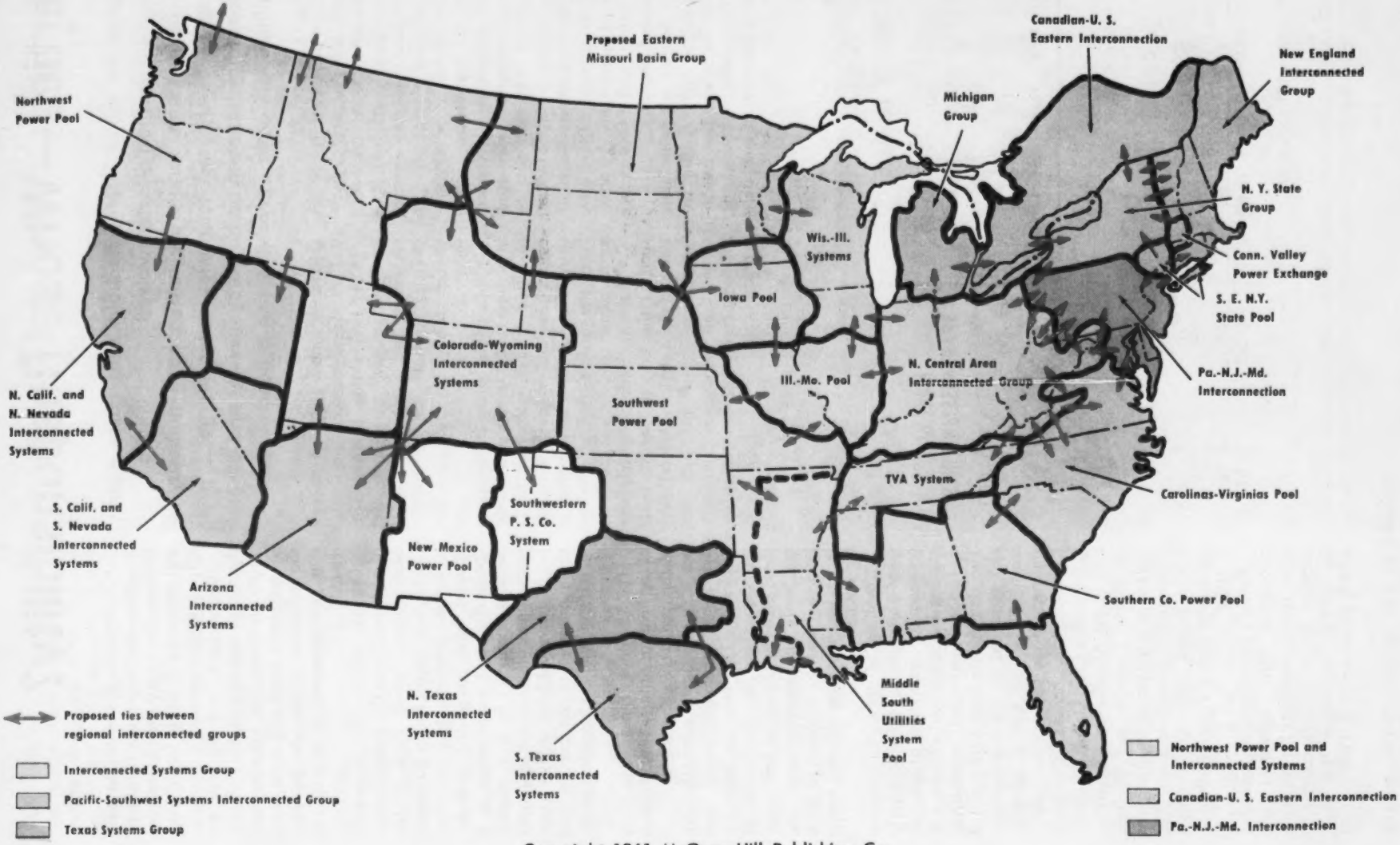
Capability and Peak Load of US Interconnected Systems —1960

	Winter Capability Mw	Individual Coincident Peak Load Mw
Interconnected Systems Group	77,000 (est)	64,400
Canadian-US Eastern Interconnection	(34,800)	(30,400)
US portion only	26,531	20,942
Pacific Southwest Power Pool	16,261	13,200 (S)
Pa-NJ-Md Interconnection	14,850	11,910
Northwest Power Pool and Interconnected Systems	14,610	11,278
Texas Systems Group	8,590	6,417 (S)
New Mexico Pool	662	466 (S)
Totals	158,504	
Total U. S. Electric Utility Industry.....	174,900	133,000

(S) = Summer peak

Planned Ties to Merge Regional Networks into National Grid

Compiled by Electrical World



Copyright 1961 McGraw-Hill Publishing Co

Interties—Whose Responsibility?

- **Initiative for major interconnections must come mainly from those utilities most directly involved**
- **Federal and state regulatory bodies have authority to encourage, promote, and, sometimes, order interties**
- **Responsibility has been accepted by investor and government utilities with other agencies giving a hand**

Though the ultimate responsibility for studying, fostering, and consummating interconnections rests with the systems directly involved, it is widely accepted that other agencies and groups have a large stake in the exercise of that responsibility.

Perhaps the concern for encouraging and promoting interconnections among systems has grown from the recognition that such ties, by definition, cannot be an individual matter. Interconnections, to attain their full effectiveness, require some surrender of sovereignty by independent systems and a wide degree of coordinated planning.

Thus a number of means have been devised to encourage the exercise of the interconnection responsibility. The variety of these means, in itself, is a reflection of our political and economic approach to such matters. For instance:

- The Federal Power Commission has legal authority to promote and encourage the interconnection of electrical systems and has widely, though quietly, exercised that authority.
- State public utility commissions in a number of states have authority to either promote or order interconnections and in some instances to require that lines be operated as "common carriers" (see table on opposite page).
- National utility associations such as the Edison Electric Institute and the American Public Power Association have provided the forums and association machinery for encouraging interconnections on a broad scale.
- Individuals, sometimes in public office and sometimes in private business, have used their knowledge and persuasive power to foster widespread interconnections.

But no matter how elaborate are the means and devices for fostering interconnections, the initiative and the authority must still come from the individual system—be that system investor-owned or government owned.

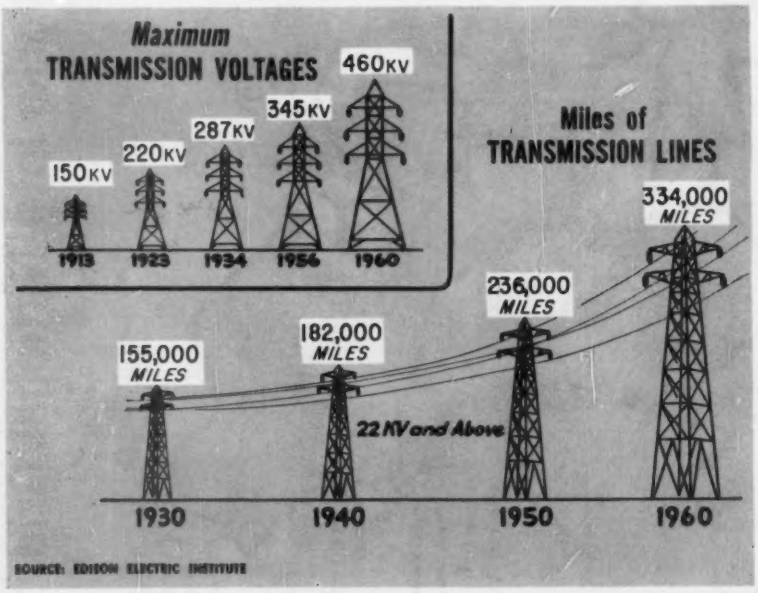
One has only to study the growth of such entities as the Pennsylvania-New Jersey Power Pool or the Connecticut Valley Power Exchange to become convinced that individual systems have recognized their responsibility and exercised it in a prudent manner. In a somewhat lesser sense, the existence of a number of individual large utilities today is an example of the pooling and merging of small, independent utility systems.

The $8 billion transmission plans of the investor-utilities in September of this year (EW, Sept 11, p 42) is probably the most comprehensive outline of interconnections ever disclosed. The map on page 61 seeks to show the significance of these plans by indicating how existing pools and interconnected systems will be tied together to form larger and more coordinated working entities.

Unveiling of these far-reaching plans also indicates the relationship between the individual utilities or existing interconnected systems and a national industrial association. The plans for the lines were initiated and produced by the various systems. EEI's role was to compile and present the plans to the public.

Driving force behind EEI's work in this field is C. E. Oakes, the chairman of the Associations Committee on Power Capacity and Pooling. Oakes is also board chairman of Pennsylvania Power & Light Co, which helped form the Pennsylvania-New Jersey Power Pool back in 1928.

Publicly owned utilities have also recognized their individual and collective responsibility for fostering interties. In his keynote address to the APPA convention this year, APPA President D. J. DeBoer told



RISE IN VOLTAGES, GROWTH IN LINES tell story of the rapidly advancing technology of transmission and its widespread application to nation's systems

his colleagues, "This country has the right to insist on the economic benefits obtainable from interconnected and pooled resources. APPA members have the right to insist that this Association leads the way in arriving at this goal." He went on to tell his public power associates that they should put aside their fears of surrendering local ownership and local control and look to pooling and interconnections as the "only means for continuation of local independent operation."

In this same address DeBoer noted that a number of interconnection studies are being carried out by municipal utility groups in several sections of the country.

The role of regulatory agencies in encouraging interconnections, while seldom obvious, is nevertheless real. Since World War II, the FPC has engaged in some 40 interconnection studies. Of these, 13 were dropped because they were found not to be feasibile. The other 27 were recommended by the commission with about a 50-50 record of results.

In many instances, the utilities involved subsequently built different lines than those proposed by FPC, but ones which accomplished the same purposes. In some instances, the investor utilities have built even bigger, stronger interties than the FPC had suggested. And in numerous instances the utilities have built interties without any outside suggestion.

"Time is solving most of the interconnection problems," FPC Chief Engineer and Power Division Chief Francis Adams told *Electrical World* earlier this year. He added, "we try to carry out these studies in a spirit of cooperation. We try to work with the systems."

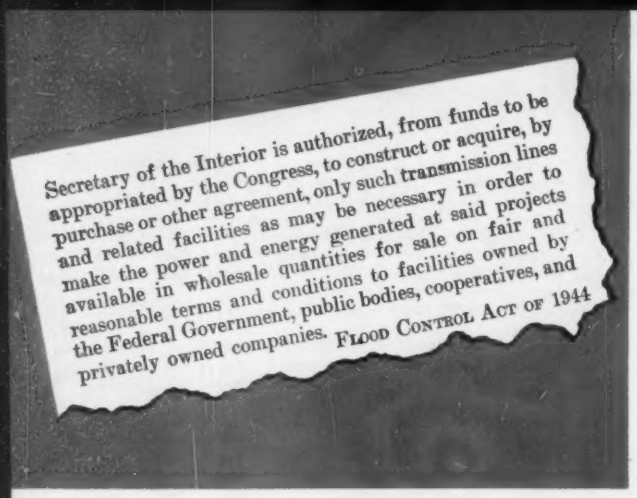
Electrical interconnections have come a long way since the 1920's when the Public Ownership League sketched its first proposal for giant tie lines across the nation.

The late Leland Olds, once chairman of FPC and for many years the most vocal proponent of widespread interties, would smile appreciatively at the scope of activity in the field of interconnections today. Many of his ideas and proposals are receiving attention and sparking debate on a much broader scale than ever was true in his lifetime.

State Commissions Have Power to . . .

	. . . Authorize interconnections			. . . Require interconnections			. . . Require utility to act as common carrier		
	Private	Public	Cooperative	Private	Public	Cooperative	Private	Public	Cooperative
Alabama	Yes	No	No	Yes	No	No	Yes	No	No
Alaska	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]
Arizona	Yes	No	Yes	Yes	No	Yes	No	No	No
Arkansas	Yes	No	No	Yes	No	No	No	No	No
California	Yes	No	Yes	Yes	No	Yes	No	No	No
Colorado	Yes	No	No[2]	Yes	No	No	Yes	No	No[2]
Connecticut	Yes	No	..	No	No	..	No	No	..
Delaware	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes
District of Columbia	Yes	..	..	Yes	..	..	No	..	..
Florida	Yes	No	No	Yes	No	No	Yes	No	No
Georgia	No	No	No	[3]	No	No	No	No	No
Hawaii	Yes	No	..	Yes	No	..	No	No	No
Idaho	Yes	No	No	Yes	No	No	Yes	No	No
Illinois	Yes	No	..	Yes	No	..	No	No	..
Indiana	Yes	Yes	Yes	No	No	No	No	No	No
Iowa	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]
Kansas[4]	Yes	No	Yes	Yes	No	Yes	No	No	No
Kentucky	Yes	[5]	Yes	Yes	[6]	Yes	Yes	[5]	Yes
Louisiana	Yes	No	No	Yes	No	No	Yes	No	No
Maine	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
Maryland	Yes	Yes	Yes	Yes	Yes	Yes	[5]	[5]	[5]
Massachusetts	No	No	..	Yes	Yes	..	No	No	..
Michigan	Yes	No	Yes	No	No	No	No	No	No
Minnesota	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]
Mississippi	Yes	No	Yes	Yes	No	Yes	No	No	No
Missouri	Yes	No	No	No	No	No	No	No	No
Montana	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
Nebraska	[5]	[5]	[5]	[3]	[7]	[5]	No	No	No
Nevada	Yes	No	No	No	No	No	No	No	No
New Hampshire	Yes	No	Yes	No	No	No	No	No	No
New Jersey	Yes	Yes	Yes	No	No	No	No	No	No
New Mexico	Yes	No	No	No	No	No	No	No	No
New York	Yes	Yes	No	Yes	Yes	No	No	No	No
North Carolina	Yes	No	No	Yes	No	No	Yes	No	No
North Dakota	Yes	No	No	No	No	No	No	No	No
Ohio	Yes	No	No	Yes	No	No	Yes	No	No
Oklahoma	Yes	No	No	No	No	No	Yes	No	No
Oregon	Yes	No	No	Yes	No	No	Yes	No	No
Pennsylvania	No	No	No	No	No	No	No	No	No
Rhode Island	No	No	..	No	No	..	Yes	Yes	..
South Carolina	Yes	No	No	Yes	No	No	No	No	No
South Dakota	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]
Tennessee	Yes	No	No	[8]	No	No	[8]	No	No
Texas[8]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]
Utah	Yes	No	No	Yes	No	No	[4]	No	No
Vermont	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Virginia	Yes	No	Yes	Yes	No	Yes	No	No	No
Washington	Yes	No	No	No	No	No	No	No	No
West Virginia	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
Wisconsin	Yes	Yes	[7]	Yes	Yes	[7]	Yes	Yes	[7]
Wyoming	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Puerto Rico	..	No	..	..	No	..	..	No	..
States "Yes"	40	10	15	29	9	11	17	6	4
States "No"[8]	10	40	35	21	41	39	33	44	46

[1] Not regulated by State commission.
[2] Unless cooperatively owned utilities hold a certificate of public convenience and necessity.
[3] Power not adjudicated.
[4] Primary power to regulate utilities operating in the confines of a single city rests with the city council.
[5] "No" except outside corporate limits of municipalities.
[6] Primary power to regulate utilities in incorporated places rests in the city council.
[7] "No" unless cooperative extends activities to include functions that make it a utility under the statutes.
[8] Includes States without commission regulation, States in which power has not been adjudicated, or States where power does not apply to major part of the operations of the utilities.
SOURCE: FPC, NARUC


Secretary of the Interior is authorized, from funds to be appropriated by the Congress, to construct or acquire, by purchase or other agreement, only such transmission lines and related facilities as may be necessary in order to make the power and energy generated at said projects available in wholesale quantities for sale on fair and reasonable terms and conditions to facilities owned by the Federal Government, public bodies, cooperatives, and privately owned companies. FLOOD CONTROL ACT OF 1944

By What Authority

- Congress holds purse strings and keeps tight control over shifts in power policy
- Constitutionality of federal moves in interconnections no longer open to question
- Legislators have been reluctant to give Interior broad powers in transmission field
- REA can loan funds for interconnections and emphasis is shifting toward transmission

The power of the purse has been the main tool with which Congress has forged a transmission and interconnection policy for the federal government. And its selectivity in determining this policy has, to a large extent, helped shape today's federal transmission map of the United States.

The Constitutionality of federal moves in the field of interconnections—whether the government is acting as builder or regulator—is no longer open to question. The Supreme Court sidestepped a determination of some of the thornier problems for a time by ruling that the mere fact that a power company was financially injured by actions of the government or its chartered corporation did not give the power company standing to sue.[1]

But the power of the United States to build dams has been generally upheld as a right constitutionally granted to improve navigation, and disposal of power generated at such a dam is allowed through the right of government to dispose of all property constitutionally acquired.[2]

Whether the government can, by its actions, force investor-owned utilities to interconnect or to wheel power at the wish of public agencies has yet to be judicially determined. It has been held that the government can condition the licensing of a hydroelectric development on public lands by requiring the attendant transmission lines to wheel power for a federal agency.[3]

This question is not likely to arise until and unless Congress grants new powers to one of the three agencies which implement federal power policy—the Federal Power Commission, the Interior Department, and the Rural Electrification Administration. It has been extremely slow to grant wide powers to any branch, reserving to itself a consideration of the time and place of each alteration in policy. The Federal Power Commission has made sporadic attempts over a period of years to induce Congress to give the Commission power to compel interconnections between interstate utilities where the Commission feels the interconnections are desirable. Congress has shown little enthusiasm for such a plan.

FPC Authority Limited

The role of the FPC in the interconnection field is now rather severely circumscribed. It is empowered to study, recommend and encourage interconnections where it thinks they are advisable, but it can compel interconnections only under very special conditions.

When the Commission, upon application of a state commission, or of any person engaged in the transmission or sale of electric energy, finds that it is necessary for the public interest, it may order an interconnection. But it cannot compel the enlargement of generating capacity, nor can it compel any exchange of energy when to do so would impair a utility's ability to render adequate service to its customers. These conditions take much of the muscle out of the clause.[4]

The "emergency" clause is much more powerful. During a war, or "whenever the Commission determines that an emergency exists by reason of a sudden increase in the demand for electric energy, or a shortage of electric energy, or of facilities for the generation or transmission of electric energy, or of fuel or water for generating facilities, or other causes . . ." The Commission may order an interconnection and specify its terms.[5]

It's not certain how far an energetic and ambitious Commission could go with either of these provisions. The first, well hedged with "thou shalt nots," doesn't seem to have much promise. The emergency provisions, though, have never received a non-wartime test. But it's certain that Congress would yank the rug out from under a Commission which abused the emergency provision.

The Commission's authority and responsibility with respect to government transmission lines is more nebulous. It has a finger in a number of federal projects, although often in a peripheral way. Its authority is derived from bits and pieces of various laws setting up government power policy.

The Commission is directed to determine a "fair value" of power from government dams and what the potentialities of power at the dams are;[6] to approve contracts for Tennessee Valley Authority projects which require the issuance of bonds;[7] sit on the advisory board for the Bonneville Power Administration;[8] and pass on Bonneville rate schedules.[9] The Commission's functions regarding Bonneville are repeated in other federal project acts.

But these functions are minor compared to the FPC's basic task of regulating the investor-owned utility industry. The net effect of

Does Government Act on Interties?

such piece-meal legislation is to give the Commission the right to be heard on some of the proposals for Interior Department power policy, but the Commission doesn't have any real authority over government operations.

The main federal administrative and executive power, as distinct from regulatory duties, is channelled through the Department of Interior and the Department of Agriculture, as well as the as-good-as-independent Tennessee Valley Authority.

Interior is usually given the authority and the funds for the most elaborate and spectacular projects —the hugh dams and long transmission lines—while Agriculture, through the Rural Electrification Administration, has historically concentrated on localized efforts.

Congress Screens Projects

Congress has examined critically each major item in appropriations for the Interior Department since the Flood Control Act of 1944[10] placed responsibility for marketing power produced at Corps of Engineers dams in the hands of the Secretary of the Interior. Each new project has gone through intense debate and many have fallen by the wayside.

When the late Harold Ickes was Interior Secretary he tried to get Congress to pass a far-reaching power marketing provision in an amendment to a rivers and harbors act. It would have granted preference to public bodies and cooperatives, and would have authorized the Secretary of the Interior, in serving preference customers, to construct transmission lines and facilities and enter into any contracts he deemed necessary to carry out his responsibilities. After bitter debate Congress rejected this approach.

The Flood Control Act of 1944 granted the Secretary less power than he had wished. It authorized him to "construct and acquire only such transmission and related facilities as may be necessary in order to make the power and energy generated at said projects available in wholesale quantities for sale on fair and reasonable terms and conditions to facilities owned by the Federal Government, public bodies, cooperatives and privately owned companies." It narrowed the Secretary's discretionary powers and put him on notice that Congress might not go too far down the transmission-building road with him.

This was borne out when the Southwest Power Administration asked Congress in 1946 for funds for steam plants and transmission lines. Congress eliminated steam plant funds entirely, cut back on transmission, and told SPA to look harder for marketing and wheeling agreements.

This general policy has held up to the present. In the last session of Congress, the bitterly-fought Upper Colorado lines were granted to Secretary Udall, with the proviso that he continue to investigate the possibility of allowing investor-owned utilities to build some of the lines.

Similar transmission construction authority rests with the Rural Electrification Administrator. Because of the nature of the REA, the Administrator does not have to submit each of his projects to Congressional scrutiny.

The Rural Electrification Administration, since its inception in 1936[11], has acted as a lender of funds and not a builder of projects. So its ability to loan funds for interconnection purposes is limited only by its total appropriations and the demands on those appropriations by other loan requests.

Shifts in Emphasis Appear

Shifts in emphasis from loans for distribution systems to loans for generating and transmission purposes have been gradually appearing in REA policy. As of the present, this has had no effect on Congressional attitudes toward REA appropriations.

In sum, there has proven to be no constitutional bar to the role of government in the business of encouraging, ordering or building interconnections. The future course of the Congress, then, is likely to be predicated on the funds available and its reading of how much the people want in the way of federal lines.

---

[1] Tennessee Power Co. v. TVA, 306 U.S. 118 (1939); Alabama Power Co. v. Ickes, 302 U.S. 464 (1938).
[2] Ashwander v. TVA, 297 U.S. 288 (1936).
[3] Idaho Power Co. v. FPC, 344 U.S. 17 (1952).
[4] 16 U.S.C. 824a.
[5] Ibid.
[6] 16 U.S.C. 797a.
[7] 16 U.S.C. 831n-1.
[8] 16 U.S.C. 832a.
[9] 16 U.S.C. 832d.
[10] 16 U.S.C. 825s.
[11] 7 U.S.C. 901.

Major Laws Dealing with Transmission

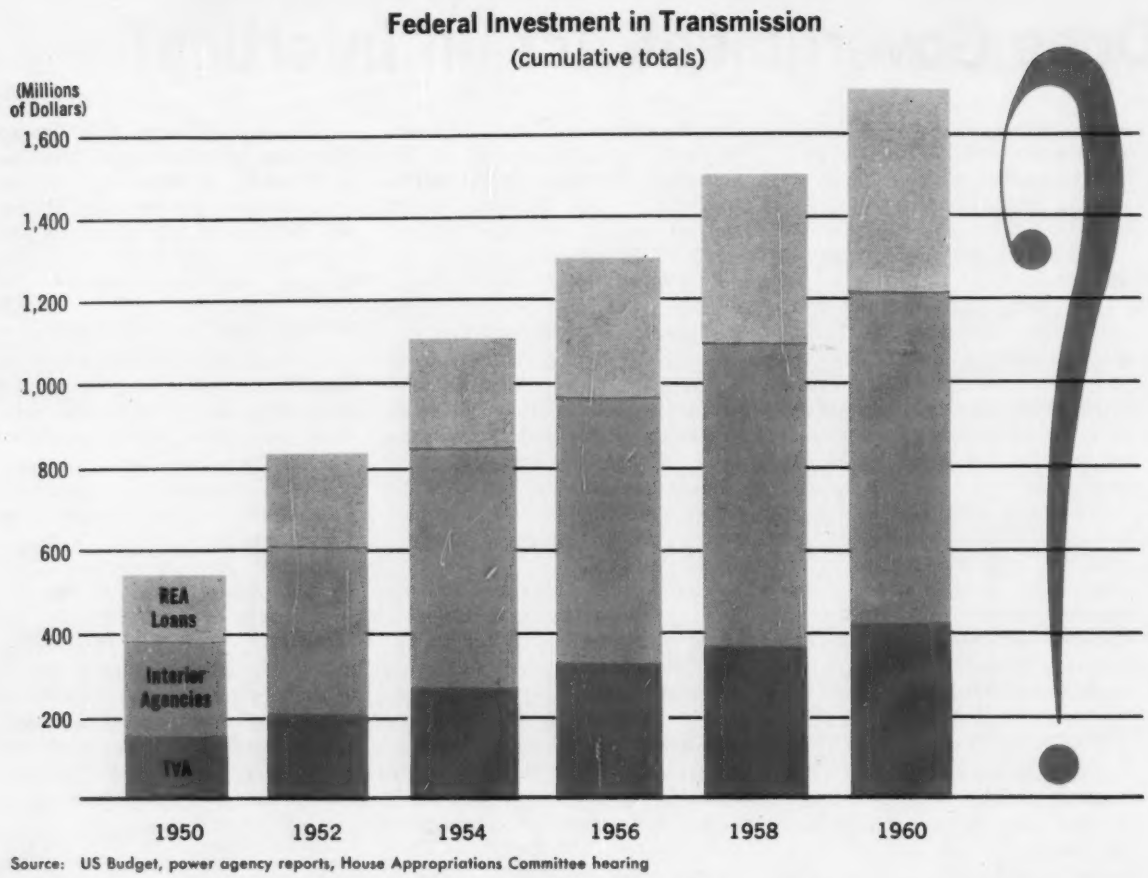
Tennessee Valley Authority Act, 1933: Created TVA as a regional development agency with authority to construct hydroelectric projects and a transmission system.

Rural Electrification Act, 1936: Authorized federal loans for construction of rural electric facilities.

Bonneville Project Act, 1937: Provided authority for creation of a power marketing agency within the Interior Department for transmission and sale of government power from projects.

Reclamation Project Act, 1939: Authorized certain reclamation projects and reiterated a preference policy practiced by Bureau of Reclamation.

Flood Control Act, 1944: Provided basic authority under which the Southeastern and Southwestern Power Administrations were created; made Interior Secretary marketing agent for power from Corps of Engineers dams.



Source: US Budget, power agency reports, House Appropriations Committee hearing

Who Pays Bill for Interconnections?

• When the federal government moves in, the costs are apportioned so that taxpayer picks up part of the tab

Over the years the federal government has invested well over $1½ billion in the construction of transmission facilities. As the chart above shows, the largest single portion of this has been in the form of appropriations to Interior Department agencies—Bureau of Reclamation, Bonneville Power Administration, and Southwestern Power Administration. Another portion has gone in the form of loans to rural electric cooperatives. Tennessee Valley Authority, which formerly relied on the appropriation process of Congress, now is empowered to raise funds from private sources through issue of revenue bonds.

When an investor-owned utility or a municipal or public utility district undertakes to build interconnections, there is no doubt who will bear the costs. The customers of those utilities will furnish the revenue which will pay for the lines. In like manner, the customers stand to share in the benefits—increased reliability, efficiency, and economy —derived from the lines.

In the case of the investor utility customers, they must also bear the burden of federal, state, and local taxes which may be assessed as a result of the line. The publicly owned utilities are exempt from most such taxes but may make contributions in lieu of these taxes.

When the federal government moves in, the picture is more complicated. First, Congress must appropriate the money for the Interior Agencies and make it available for the Rural Electrification Administration loans. All of this is to be repaid over a set number of years, but the interest rates that have been set for these agencies are well below the current cost of money to the Government, itself.

For instance interest rates set for the Reclamation Bureau is 3%; for BPA and SWPA, 2½%; for REA borrowers, 2%. Over the past three years the going rate of interest on long-term government borrowings has ranged from just over 3.4% to a little over 4% on a yearly basis. To the extent that the interest rate for the government agencies is below the interest rates paid by the government, the government lines are subsidized by the taxpayers of the nation.

Further, to the extent that the lines might have been built by investor-owned companies and returned revenues to them, the federal and other governmental units suffer a tax loss.

What Is 'Common Carrier'?

- The phrase is used frequently in Administration statements relating to electrical interconnections and regional ties
- It has never been precisely defined in that sense, although it is sometimes equated with "wheeling" of power
- A meaningful definition might be written, but it would be far cry from the original meaning of the phrase

The phrase, "common carrier," although used extensively by the Kennedy Administration in reference to electrical transmission and electrical interconnection, has never been precisely defined in that context.

One might be led to suspect that the phrase was chosen more for its euphonius than for its descriptive qualities.

Webster defines "common carrier" as "One who undertakes the office of carrying goods or persons for hire and for all persons indifferently . . . by analogy, any public utility or public service company."

The legal definition of "common carrier" might run something like this: "the owner or operator of instrumentalities or facilities who holds himself out and offers to transmit or transport, for hire, goods, wares, and merchandise of all owners thereof who apply for such services and are ready, able, and willing to pay the standard published tariff for such service. Such carriers are generally subject to government regulation."

Neither of these definitions could be precisely applied to the transport of transmission of electric power because of the lack of a requirement that the "common carrier" act instantaneously to move such goods or wares—or in this case power and energy. The usual and the legal definition would appear to permit the "common carrier" to transport or transmit goods and wares as it is able to do so in the normal course of its business rather than at the instant they were received or at any specific time.

Thus the ordinary definitions of "common carrier" cannot be easily applied to electric utilities or their facilities.

Reclamation Commissioner Floyd Dominy, a key administration official in the power area, has said that the wheeling arrangements of the Southwestern Power Administration area come closest to the "common carrier" concept of the Administration.

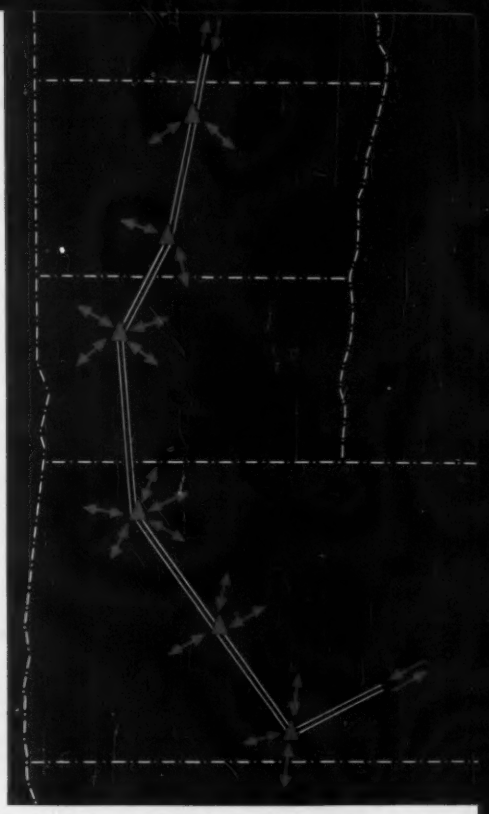
However, spokesmen for investor-owned utilities which played a leading role in developing the "wheeling" arrangements in the SWPA area vigorously dissent from the Dominy opinion. They argue that the idea of a wheeling contract is a specific agreement between two or more parties—not open to all comers and not mandatory without agreement.

Thus, there is no weighty body of opinion that would equate "wheeling" with "common carrier."

The term "common carrier" has been loosely applied to provisions in licenses issued to electric utilities to permit them to construct transmission lines across public lands. Licenses issued from 1948 to 1954 carried the proviso that any excess capacity in these lines should be available to the federal government for use in the transmission of power and energy. There is no record that the government ever sought to make use of the lines under such provisions.

Former Interior Undersecretary Clarence A. Davis told a Congressional Committee in 1955 that such provisos in public lands licenses were a matter of administrative discretion. "As a matter of law," said Davis, "there is no mandate from Congress. On the contrary, Congress has failed for a very long period of years to include any provision with reference to common carriage, government carriage, or otherwise . . ."

There is little precedent to go on in defining "common carrier" as applied to electrical transmission and interconnection. Still it cannot be denied that the phrase is used in this context and that it appears to carry some meaning.



"COMMON CARRIER" line might serve several utilities at points along route

A suggested definition is this:

Common carrier *(as applied to electrical transmission and interconnections). Utility facilities that may be made available to utilities other than the owner for the transmission of power and energy. Such facilities would have sufficient capacity to take care of foreseeable requirements in the most economical manner. Such facilities could be provided only through coordinated and wise planning of utilities which, through ownership or mutual agreement, are entitled to use such lines.*

Admittedly such a definition of "common carrier" is far from the normal meaning of the phrase. But as Humpty Dumpty in Lewis Carroll's "Through the Looking Glass," remarked, "When I use a word, it means just what I choose it to mean —neither more nor less."

"The question is," said Alice, "whether you can make words mean so many different things."

Will Preference Snag Interties?

- **Preference clauses of various power laws could act to slow down proposed giant federal interconnections**
- **Controversy is already swelling up in the Pacific Northwest as Bonneville-California intertie is studied**

Biggest single stumbling block to widespread federal interties may well be the issue of preference.

There is a great splotch of irony in this. The very federal power advocates who would maintain the sanctity of the preference doctrine must also wage the fight for the huge federal interties.

Preference customers in the Pacific Northwest, faced with the first of the tie lines, are already examining the risks. Priority customers of federal power in other areas may soon be doing the same.

In essence, the big questions being posed are these:

1. Would widespread federal interconnections dilute benefits being received by existing preference customers?

2. Will it be necessary to tamper with preference clauses in order to permit the interconnection of federal systems?

3. Can some benefits of interconnection be obtained without upsetting present marketing arrangements?

To understand what is involved in these crucial political questions, it is necessary to see how they arise.

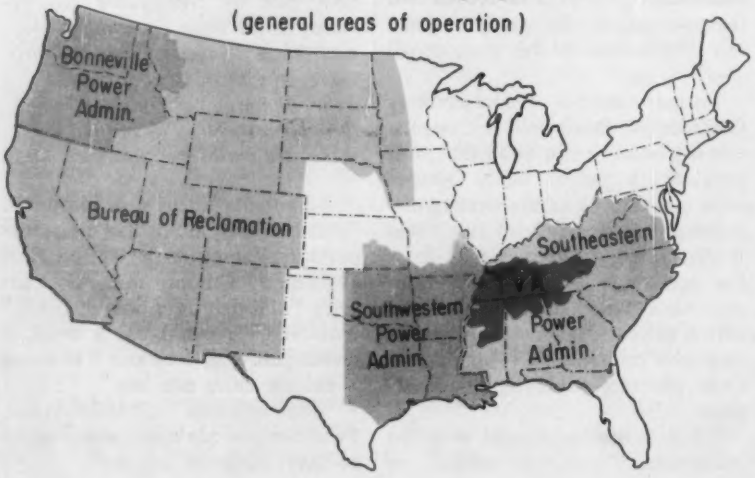
The doctrine of preference is relatively simply. It is that public bodies and cooperatives have a priority position for the purchase of power produced at federal generating facilities. In short, after the needs of the federal government have been met, the public bodies and cooperatives come first.

But Congress has chosen to apply the doctrine in widely varying degrees. In the Bonneville Project Act of 1937, the preference clauses were so written as to encourage citizens to break away from investor-utility service and form their own public or cooperative utilities in order to obtain the cheap government power. The government even assisted in organizing such preference utilities, and assured them first call on government power as they wanted it.

More typical is the "come and get it" preference of the 1944 Flood Control Act. In this and other public works acts containing the preference clause there is recognition of established power marketing patterns. The government is discouraged from building duplicating transmission lines to serve preference customers when they can be served over existing lines at reasonable rates. The expressed intent of Congress in the acts is that the power and energy from these government projects be transmitted and disposed of so as to encourage widespread use at the lowest possible rates consistent with sound business principles.

Federal Power Marketing Agencies

(general areas of operation)



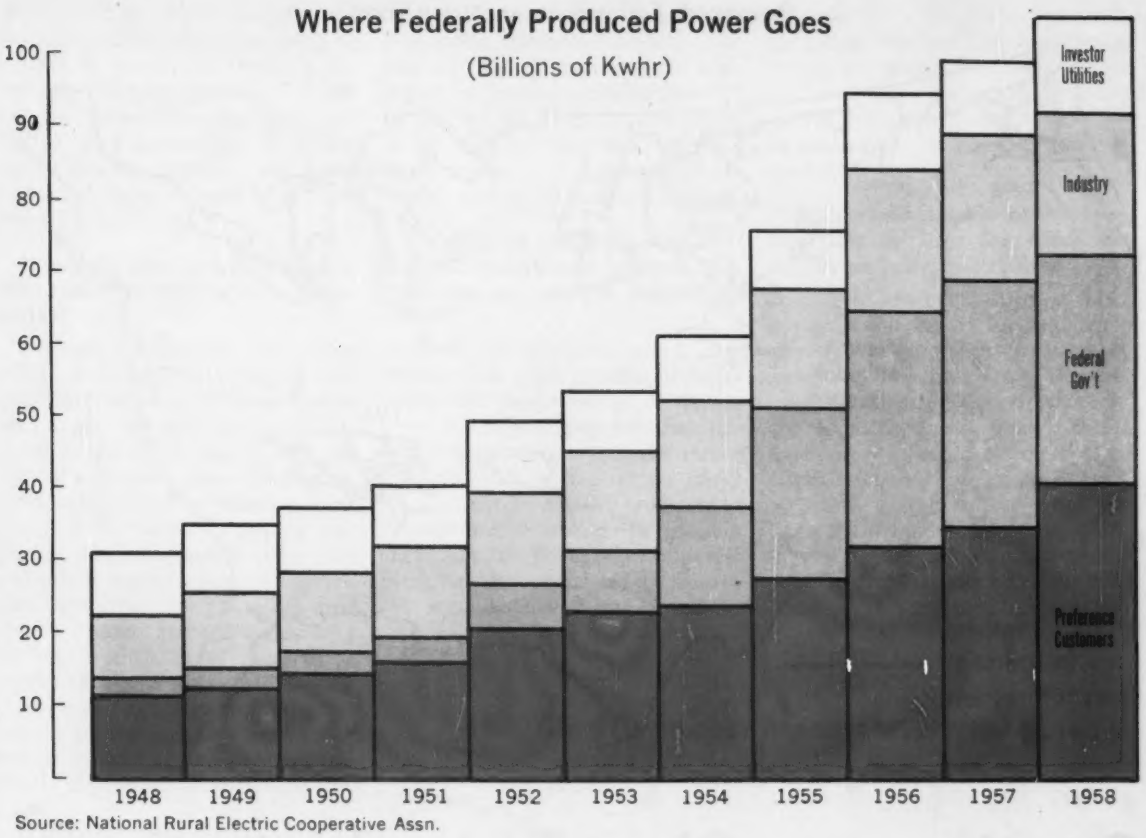
The preference doctrine has been used in the Bonneville area to create new utilities organized to gain preference status. In the Tennessee Valley Authority area, it was a big factor in chasing all investor utilities from the area. In other areas, preference has been used to vastly change marketing patterns.

The preference clauses in the various public works acts have given the publicly-owned utilities and rural electric cooperatives a large vested interest in the entire federal power program. The public utility districts, the municipals, and cooperatives in the Pacific Northwest lean on the Bonneville Power Administration as their major source of supply for electric power. Municipals and co-ops in the TVA area look upon that agency as their sole source of supply. In other parts of the country where federal generating plants are in operation, the preference customers have become heavily dependent upon that source of power supply.

The Interior Department, as boss of all federal marketing agencies outside the TVA area, has used the vast powers of the government not only to serve preference customers with federal power but to help them obtain additional power to firm up the government supply.

Preference customers have reciprocated by giving their support through powerful lobbying organizations to vast federal power programs—including both generating and transmission facilities.

Both the National Rural Electric Cooperative Assn and the American Public Power Assn have dutifully supported the studies for the proposed interconnection of federal power systems. But as the showdown approaches on the Bonneville-California intertie, a severe schism is appearing in the ranks



Source: National Rural Electric Cooperative Assn.

of the preference customers.

So long as the government power agencies were able to restrict their marketing areas to what had been considered economic transmission distances from federal projects (see map opposite page), preference customers in the area knew where they stood. They had a reasonable chance of obtaining a fixed amount of their power supply from the federal government.

But huge federal regional interties would change that. For all except one or two clauses, there is nothing to prevent preference following the paths of the lines. The existence of a line from the Bonneville area to southern California or even to the Upper Colorado basin would ordinarily presuppose that it is economic—and thereby these areas come within the economic transmission distance of Bonneville.

It appears probable that preference customers such as the City of Los Angeles, possibly the Sacramento Municipal Utility District, and numerous other public and cooperative utilities in the new areas will want to exercise their privileges.

This is just what such dependable federal power advocates as Sen. Warren G. Magnusen (D-Wash.) are afraid of. Said Magnusen recently, "They will have to convince me that if the spigot is ever turned on, that we have the power to turn it off."

The non-preference customers in the Bonneville area would be the first to be hit by the dilution of federal power supply in the area, but the preference customers would not be far behind. The threat of tapping this valuable source of hydroelectric power for transmission over vast areas of the west brings visions of economic dislocation in the Northwest.

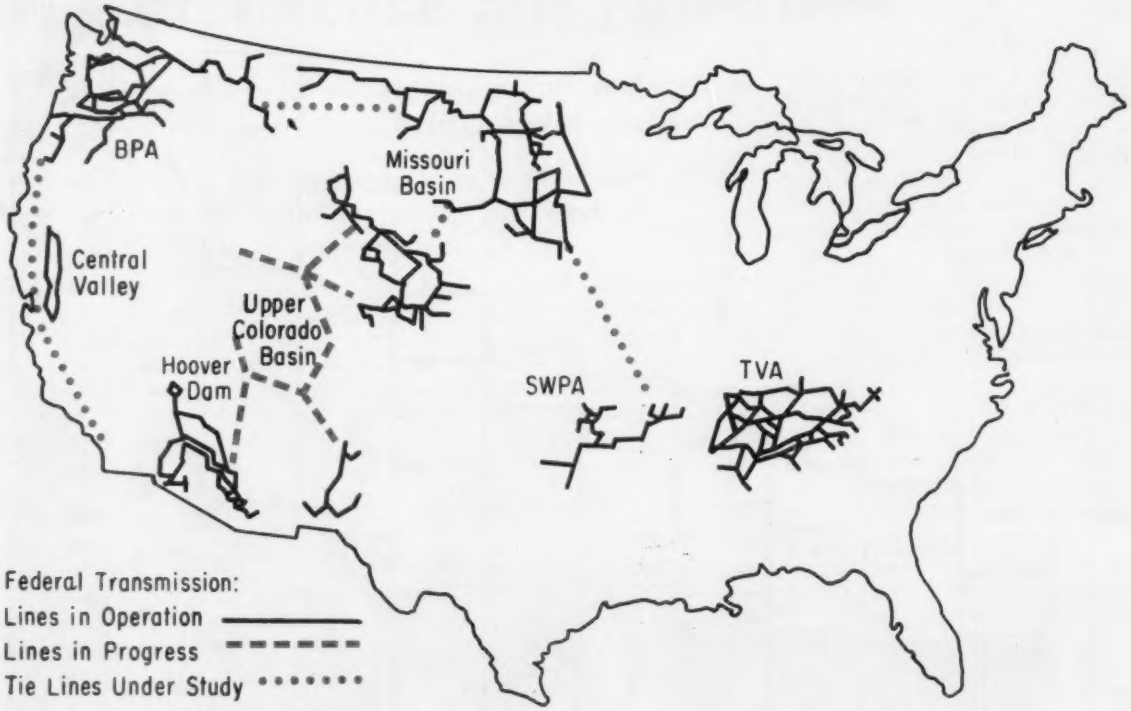
This threat has been recognized by the Kennedy Administration. To counter it, an area preference has been proposed. In theory, this would impose an area preference over the very rigid preference clause of the Bonneville Act. Under the area preference, non-preference customers in the present Bonneville marketing area would outrank preference customers in other areas.

But this proposal immediately raises as many imposing problems as it seeks to solve. First, there are doubts that Congress could afford to downgrade the long-standing preference clauses. Second, there is doubt that the NRECA and APPA could bring the full weight of their membership to support such a mangling of the preference doctrine.

Thus comes the question: Is there a way out? Can some benefits of interconnection be obtained without tampering with preference or upsetting present power marketing arrangements?

The one obvious way out is for the federal government to turn to the investor-owned utility companies. In the case of the Bonneville, ties with utilities to the south might very well offer opportunities to dispose of a portion of its surplus power. This would aid Bonneville in preserving the integrity of its present marketing area and forestall any drastic tampering with the preference clause. It would also save a substantial federal investment in giant transmission interconnections.

Proposed Federal Interconnections



Questions on Giant Federal Interties

- **Congress has provided funds to study economics and technical feasibility of large regional interconnections.**
- **Desirability and political feasibility of these ties should also gain attention of Congress and the public**

Congress this year granted funds to begin a study of the feasibility of the giant interties indicated by the dotted red lines on the map above. In subsequent talks around the country, Asst Interior Secretary Kenneth Holum has called for a vast enlargement of these studies to cover tie lines between every one of the federal power systems.

At most, these studies, already estimated to cost a minimum of $600,000, will touch upon the economic and technical feasibility of the proposed giant interties. The desirability and political feasibility of the proposed giant ties raise searching questions. Congress chose not to weigh them at the time it granted funds for the studies.

But before the welter of figures and conjecture from the studies obscure these fundamental questions, they should be raised for public consideration and public debate.

Among the questions are:

Who should make the studies?

Congress has approved the funds for the Bureau of Reclamation, in the Interior Department, to carry out the studies. Yet one may ask whether this is the proper agency. After all, this is the agency that will also make the assumptions on which the studies are based. This is the agency whose systems are directly involved. This is the agency which also would build the lines if they are to be built. This is the agency that would be affected most by the outcome of the studies. Thus, one is almost forced to ask whether a thoroughly objective study can be expected. Would it not have been more prudent to have selected some other agency such as the Federal Power Commission, which has both the authority and the competence, to conduct these studies?

Is there precedent for the giant federal tie lines?

Though the open-end language of some of the public works laws may be used to justify studies and proposals for such ties, it would appear that the lines themselves would be such a striking departure from established practice and policy as to deserve extended study and debate by Congress. Certainly the proposal for any vast loop from the Northwest through California with "common carrier" provisions would set precedent. Furthermore, it would raise several national policy questions that have never been settled. Among these are: How far should the government go in assuming utility responsibility for its customers? How far is Congress willing to go to provide facilities for transport

of power from investor-owned utilities? Can federal marketing areas be limited if there are facilities for carrying federally produced power over vast areas? How far should the federal government go in aiding highly developed states and areas with funds from citizens in the less favored states?

Would the giant ties advance federal control of the nation's power supply?

Another look at the map above would indicate that the answer might well be "yes." Proposed lines such as the one through California, if federally owned, would open up vast new federal power marketing areas. Additional preference customers would likely be tied in and become more dependent upon federal power supply. Some observers who have given thought to the proposals foresee pressure mounting for the firming up of the federal supply with huge steam plants. Such plants would either be owned by the federal government or, because of federal control of the tie lines, be wholly dependent upon the government.

If such lines are operated to transmit power from adjoining systems, then these systems will become more dependent upon the government and federal control will be extended.

Whatever may be the ultimate intent of the proposed giant federal ties, the physical facilities and the vast areas covered would put the federal government in an advantageous position to substantially advance its control over electric power in large sections of the country.

Would the giant federal ties duplicate existing or planned facilities?

In some cases, the answer already appears to be "yes." A study of the published plans of investor-owned systems (EW, Sept. 11, p 45) shows that heavy and extensive interconnections either are in being or will be built in the areas covered by the federal proposals. An EHV line is already under construction by Arizona Public Service Co between Phoenix and the Four Corners area. Any federal tie seeking to interconnect Hoover Dam and the Upper Colorado basin would duplicate this line in part. There are lines in being and still others planned in California that are capable of transporting Bonneville Power southward. The map on page 61 indicates the high degree of interconnections that will be reached by 1970. Studies which do not take full cognizance of these interconnections run the risk of extensive and extravagant duplication.

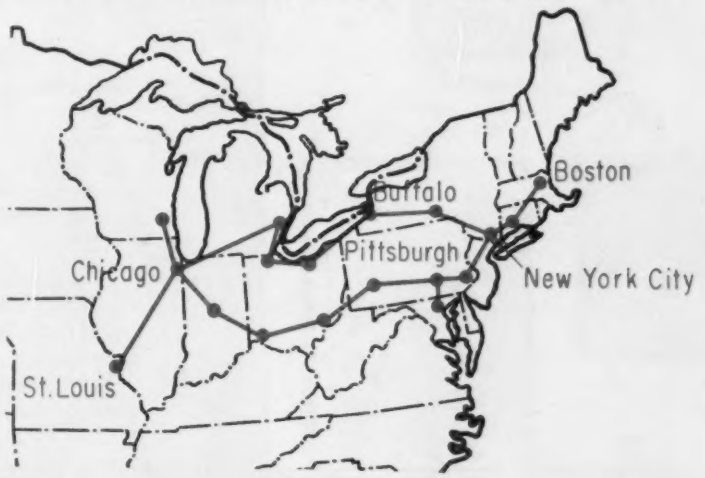
Would giant federal tie lines conflict with the national network that, within the decade, will blanket the nation?

Could not the government seek contracts or other suitable arrangements for transporting its power over the transmission systems already in existence or planned rather than build its own giant tie lines? Might it not be more appropriate to conduct initial studies on possible interconnections with regional power pools and interconnected systems in the immediate vicinity of federal systems? Or is the government, with tax exemptions and subsidized funds, intent on preempting the heavier backbone lines that would normally evolve from other interconnections in existence or on the drawing boards?

Who would stand to benefit from the giant tie lines for which the studies are being undertaken?

If there are benefits, they would appear to go mainly to those areas already receiving cheap government power. All of those areas are west of the Mississippi. Few could be classed as depressed areas. Several have already been the recipients of sizeable federal assistance. Even if no benefits were derived from the lines, these would still be the areas in which the government would pour additional hundreds of millions of dollars for construction,

1940 Giant Tie Proposal Abandoned After Study



In 1940, a 287-kv grid to connect more strongly the major industrial centers in the US Northeast was proposed by Leland Olds, Chairman of the FPC. The proposal was abandoned following a study by a group of electric utility engineering executives. They reported to Olds on January 12, 1941.

The report concluded that ". . . economically, and as a defense measure, the proposed high tension interconnecting network does not, in our judgment, justify itself."

First, the report stated that 919,000 kw of capacity might be gained because of the grid. But this required $400 million, about $435 per kw. This was considerably more than the cost of installing generating capacity.

Second, the existing high tension network was made up of a large number of transmission units. The multiplicity of transmission units limited the effects of any disruption.

Third, substantial gains could be made by extending existing interconnections. These extensions could be made more quickly and for only a small fraction of the $400 million that the proposed grid required.

should the lines be built.

Who would stand to lose from construction of federal interties?

Certainly the taxpayers across the nation would lose to the extent that the government investment is subsidized and there is no allowance for federal contributions in lieu of taxes on revenues derived from the lines. Other areas of the country would stand to lose in so far as industries left them in hopes of benefits from cheap government power areas. Cities, counties, and states along the path of the giant tie lines would stand to lose taxables from their rolls as rights-of-way were acquired by the federal government. State governments might also stand to lose revenue in so far as the federal government moved into business activity that would otherwise be carried out by tax-paying utilities.

Would the giant ties aid the small isolated municipal or cooperative utility system?

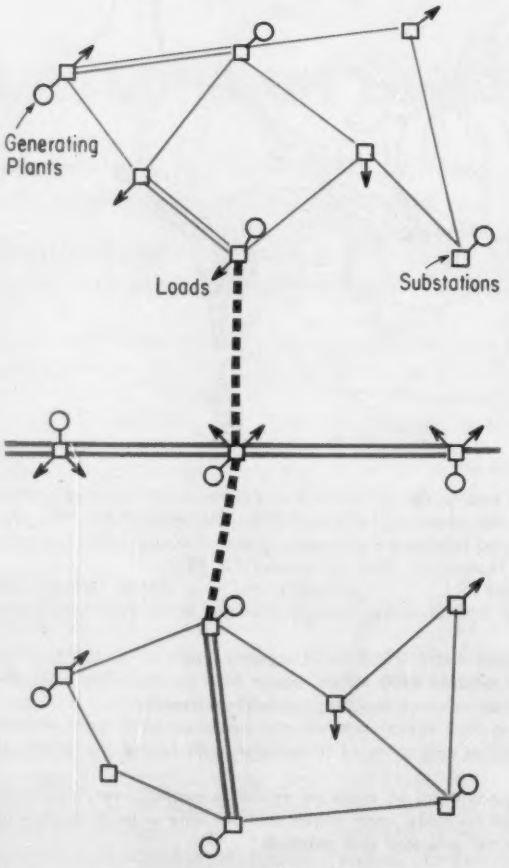
The huge expense ($1- $4 million for a substation depending on size) of tying into one of these high-voltage, high-capacity lines would rule out any direct connection for smaller, isolated systems. This is true even though the giant federal lines should run right through the service area of one of these smaller systems. In effect it would be like the super highway that intersects a small town with no access to the highway. The only way for these smaller systems to be tied to the large lines would be for them to form groups with other systems.

Would these giant ties be more vulnerable to outage than existing networks of large interconnected systems?

The extremely long distances and potentially high loadings even of double circuit lines appear to be putting an awful lot of eggs in one basket. Natural or man-made disasters which would affect the operation of the line at any single point along the hundreds of miles might very well put the entire line out of service until repairs are made. One engineer has likened the giant tie to a rope and the power network to a fish net. A person clinging to a rope would be washed adrift if the rope broke. He likely would not if he were clinging to a fish net and one of the strands broke. Extending the metaphor, a power system depending on a giant tie would be cast adrift if the tie broke.

It would not run the same risk if it was securely tied to a power network and one of its strands were severed.

Glossary of Interconnection Terms



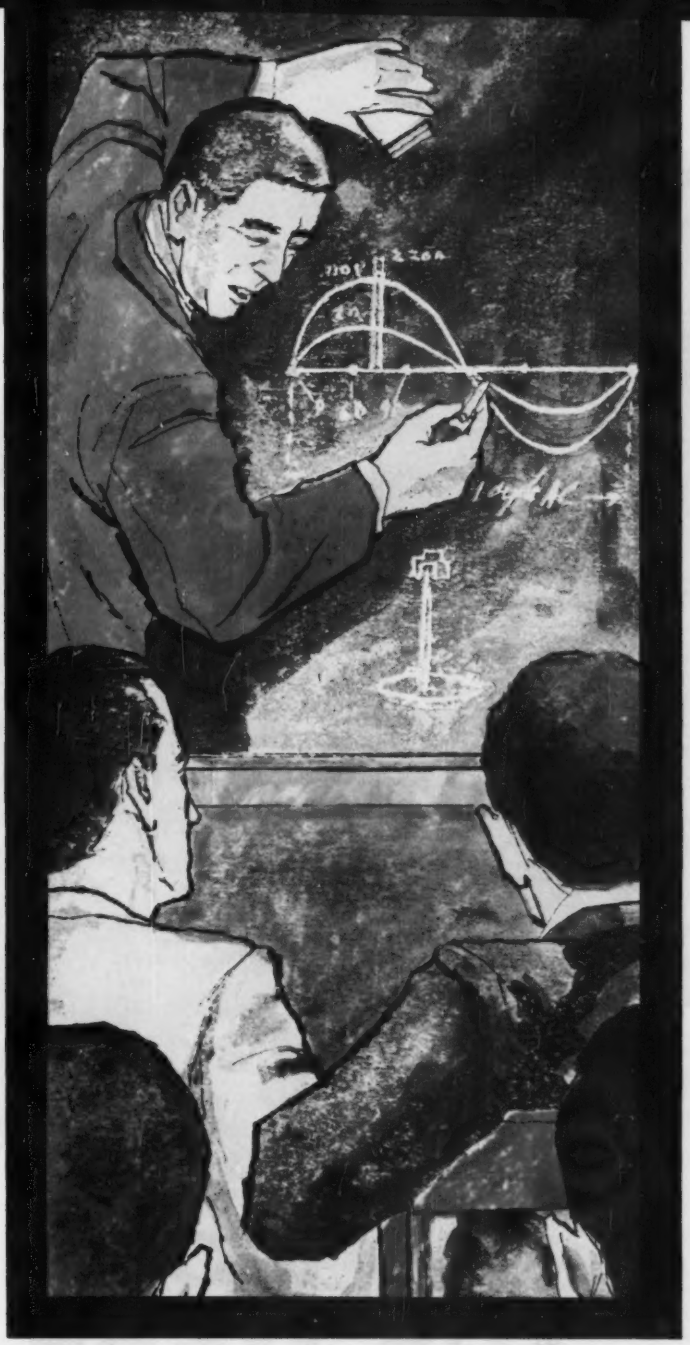
. . . **a network** is an interconnected system of transmission lines constructed to provide multiple connections between sources of load and generation. It resembles a bed spring that can be pushed and pulled at many places and still stay together. It can also lose links without serious results

. . . **an interconnection** is a transmission line which connects two electric systems or networks and permits the transfer of energy in either direction. It is also called a **tie line**. Larger interconnections are often called **interties, giant ties,** or **regional interconnections**

. . . **a backbone** is a high-voltage, high-capacity line, or group of lines, having a limited number of large capacity connections between sources of load and generation

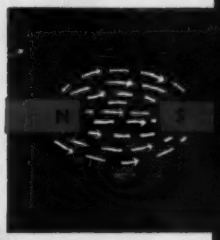
. . . **a grid** is an interconnected system in which high-voltage, high-capacity backbone lines overlay and are connected with networks of lower voltages. A **giant grid** is generally a very large regional or national system of backbones and networks

For reprints, write Electrical World, 330 W 42nd St, New York 36, NY. Prices on request.



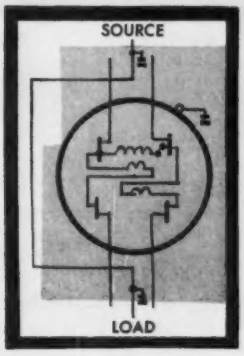
Background and history of metering

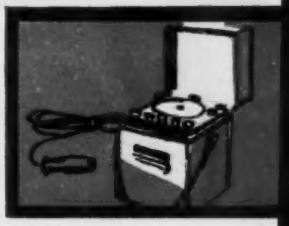
Principles of electricity, magnetism



Components and their functions

Application and installation





Testing, inspection and maintenance

ANOTHER GENERAL ELECTRIC METERING EXTRA . . .

Meter courses help utilities train personnel

Two meter courses—one each on single-phase and polyphase designs—are conducted by General Electric at its Somersworth, N. H. plant and utility locations to assist utilities in training their personnel.

Basic information and new metering advances are provided on all single- and polyphase subjects, plus field training on demand meters and registers.

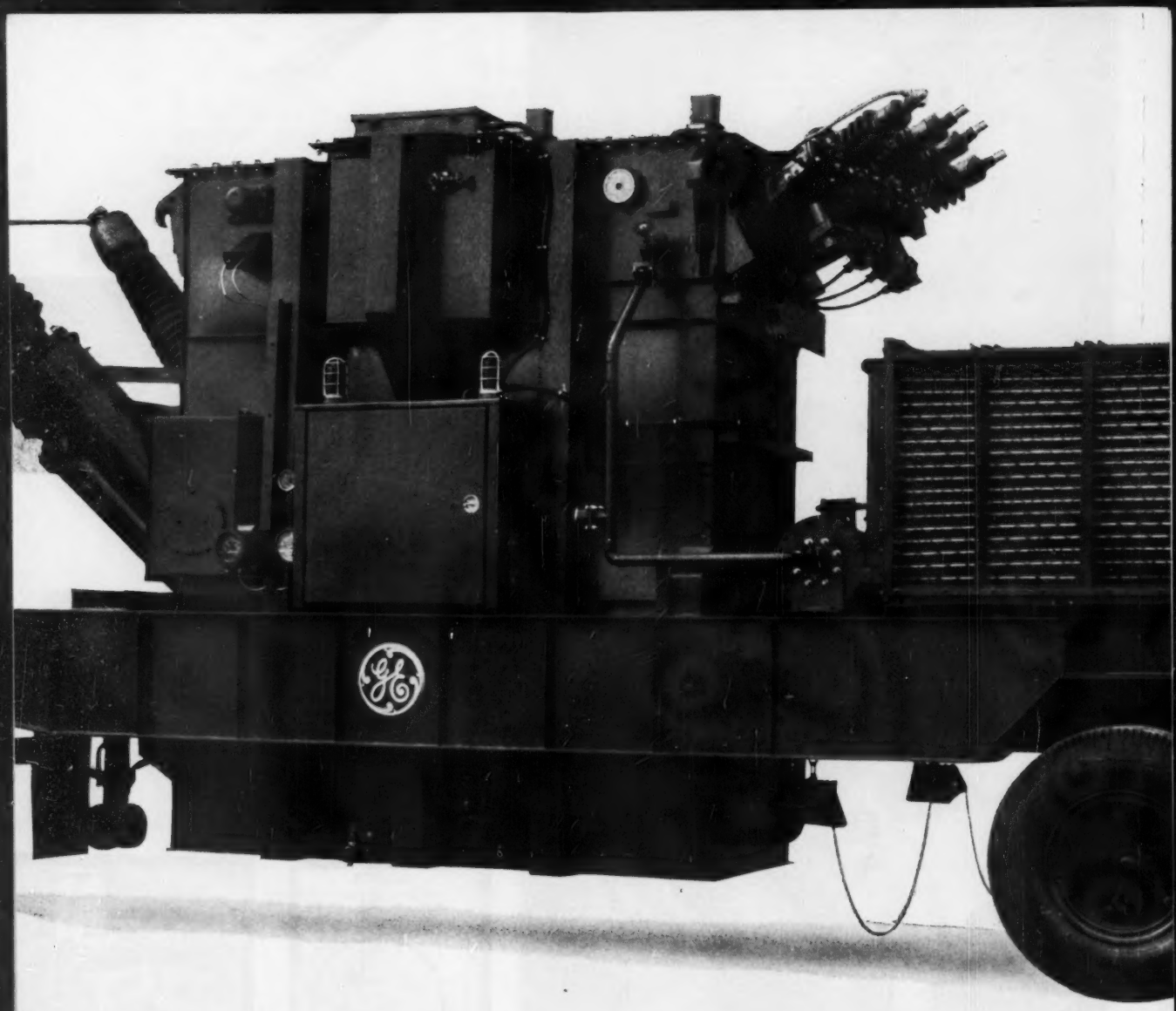
For example, the single-phase course covers five areas: background and history; principles of electricity; components and their functions; how to select and install meters; how to test, inspect and maintain meters. The polyphase meter training course is equally as comprehensive.

Complete courses are available in kit form for inclusion in utility training programs. For more information on how your metering personnel can benefit from these courses, contact your General Electric Sales Engineer. 713-11

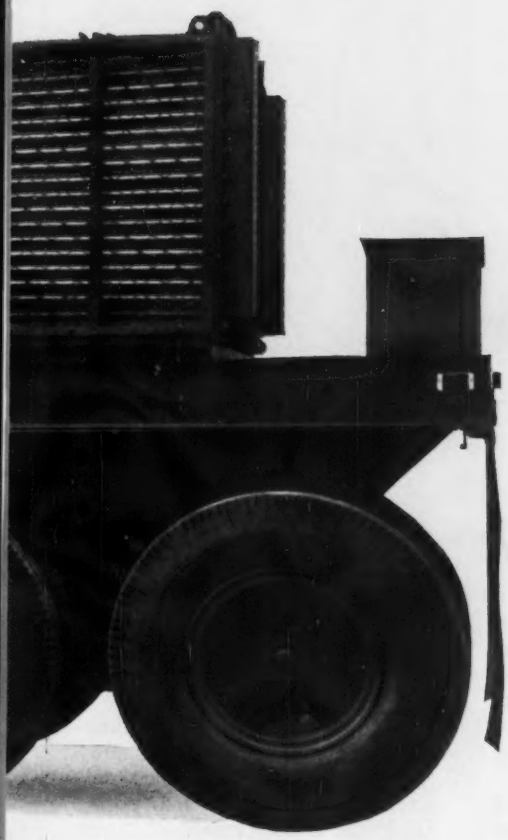
YOU GET ALL 10 METERING EXTRAS FROM GENERAL ELECTRIC

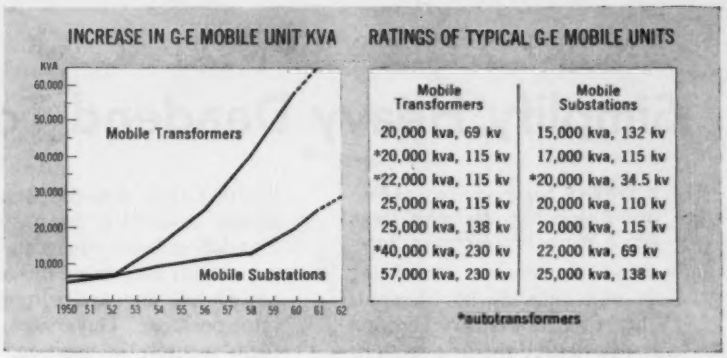
- Jet Stream Service
- Statistical Sample Testing Seminars
- Certified Quality
- Meter Courses
- Low Cost per KVA
- Application Assistance
- Product Service
- Load Building Programs
- Industry Communication
- Local Personalized Sales-Service

GENERAL ELECTRIC



MORE AND MORE KVA ON WHEELS





100,000 kva on wheels? It may well be possible—*soon*. Pioneering design innovations by General Electric are pushing the limits of mobile capacity far beyond those envisioned only a few years ago.

Mobile substations rated as high as 25,000 kva and mobile transformers up to 57,000 kva are already in service or on order from General Electric . . . and even larger units are yet to come.

This progress means you can now multiply the economies of mobile units by extending their application to include even the larger substations on your system. Behind this ever-increasing capacity are such major G-E advances as these:

• **75C operation,** permitting 25 percent more capacity than the conventional 55C operation. Thermally superior Permalex® transformer insulation permits operation at the higher winding temperatures with normal transformer life expectancy.

• **Reduced insulation levels** (BIL) permit even more dramatic gains. For instance, a two-step reduction in high-voltage BIL of a 138-kv unit means up to *67 percent greater capacity*, with no increase in size or weight.

• **New lightweight internal switch** saves as much as 3500 pounds in over-all weight, increasing available capacity.

Through such innovations, General Electric continues to lead the industry in providing more and more mobile kva per pound on the road to match your growing loads. For full information on high-capacity mobile substations and transformers, contact your G-E Sales Engineer. Or, write General Electric Co., Section 422-45, Schenectady 5, N. Y. *Power Transformer Dept., Pittsfield, Mass.*

Progress Is Our Most Important Product

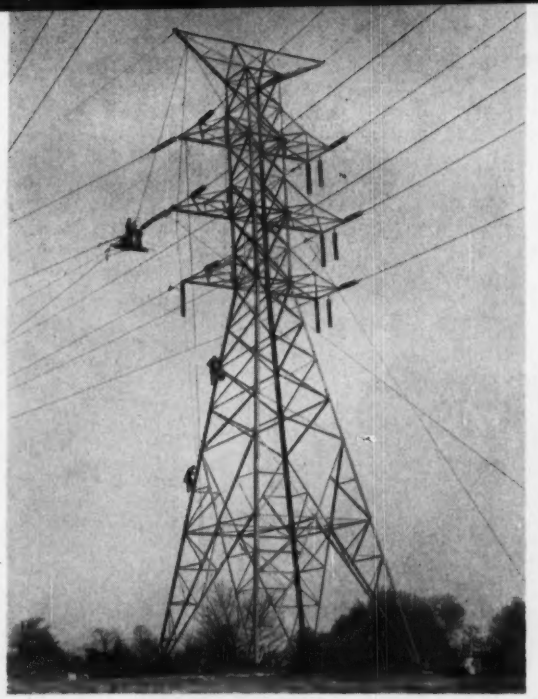
GENERAL ELECTRIC

Platform Aids Top Work

J. R. OWENS, Superintendent of Electric Distribution, Memphis Light, Gas & Water Div, Memphis, Tenn.

Even on tower work, where heights are too great for aerial baskets, men are being kept in position to work most efficiently by power equipment. Tower crews of the Memphis Light, Gas & Water Division are using a working platform which is elevated to working position and held there by the winch line of the conventional truck. Two men work from the platform.

With this arrangement, men work in a more comfortable position than when swinging from a ladder suspended from a tower arm. Therefore, they can do more work, do it better and more safely and do it at a lower cost.



PLATFORM, suspended from winch line and positioned for maximum working efficiency, speeds tower line work

Simplify Heavy Deadend Tower Erection

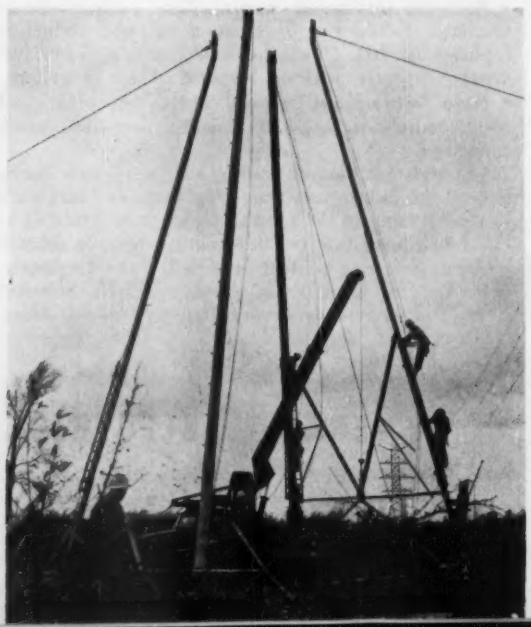
J. R. OWENS, Superintendent of Electric Distribution, Memphis Light, Gas & Water Div, Memphis, Tenn.

Deadend towers are being built more quickly by Memphis Light, Gas & Water Division crews by setting the first sections of tower legs the way poles are set, using a Hydra Crane. The Hydra Crane sets the first part of the tower leg down on the foundation bolts where they are guyed with lines to get the correct angle while they are being bolted into position. Guys also keep them securely in position.

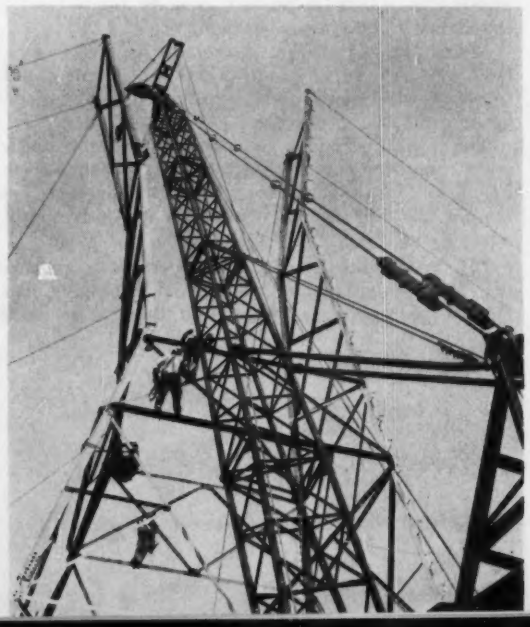
The tower is built to the "bend line" in this manner. Then, the top portion of the tower is assembled in sections on the ground and set in position with a large crane.

This method of construction is used only where towers are too heavy to be assembled on the ground and lifted into position with a large crane.

TOWER LEGS are set like poles, using a Hydra Crane



UPPER tower is raised to position with the large crane



ONE
MILLION
IN
SERVICE!

FOLLOW THE LEADER

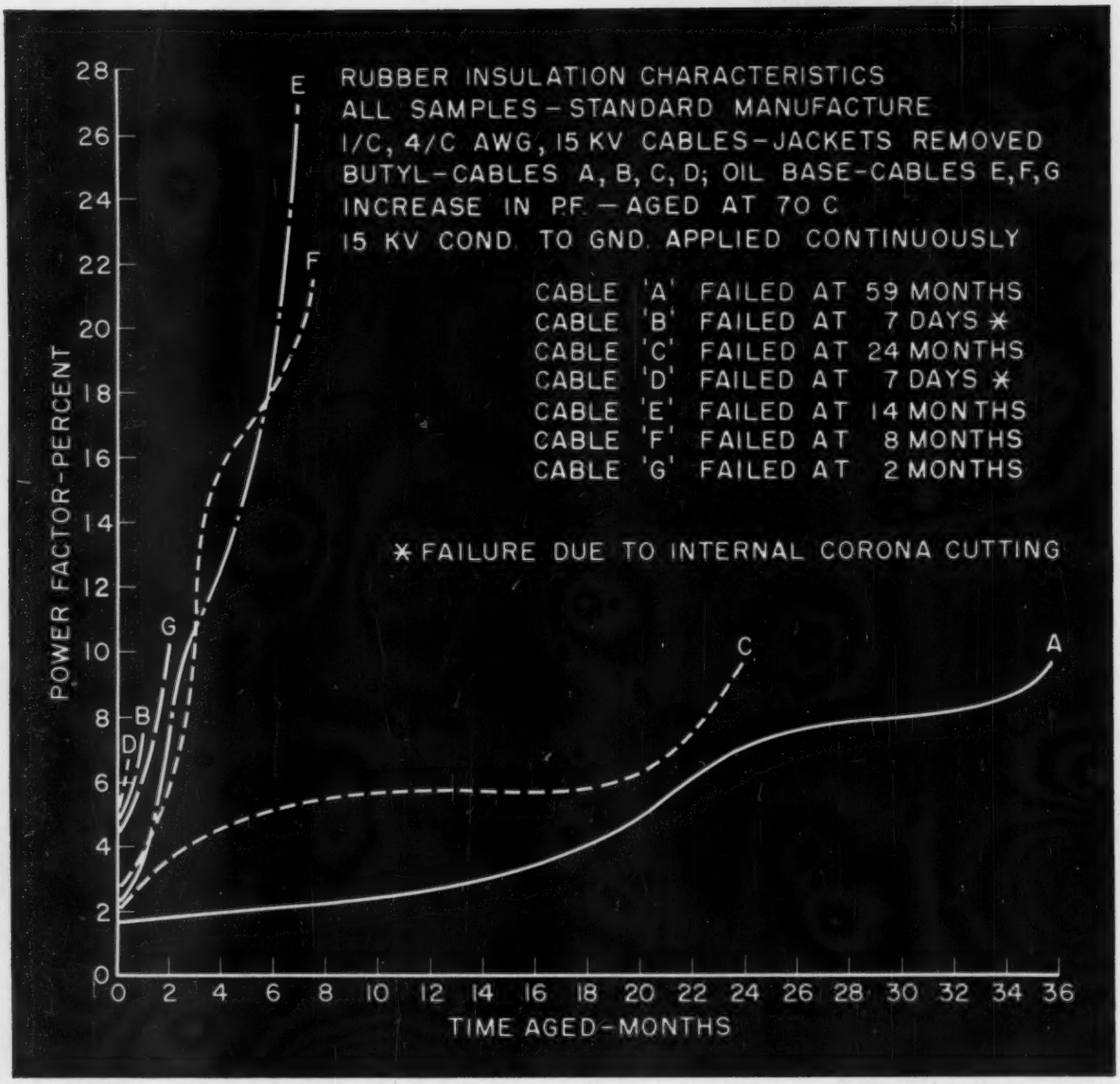
One million General Electric Magne-valve distribution arresters are providing reliable system protection for over 3000 General Electric customers. ■ Since its introduction in 1953, the Magne-valve arrester has led the field.* All attempts to duplicate its quality features and reliable performance acknowledge its foremost position in the industry. Watch General Electric for tomorrow's arrester leadership, too.

General Electric Company, Section
488-10, Schenectady 5, New York

Progress Is Our Most Important Product

GENERAL ELECTRIC

*FIRST valve arrester with • magnetic gap • small size • light weight • 100,000-amp discharge capability • greater thermal capacity


RUBBER INSULATION CHARACTERISTICS
ALL SAMPLES – STANDARD MANUFACTURE
1/C, 4/C AWG, 15 KV CABLES – JACKETS REMOVED
BUTYL – CABLES A, B, C, D; OIL BASE – CABLES E, F, G
INCREASE IN P.F. – AGED AT 70 C
15 KV COND. TO GND. APPLIED CONTINUOUSLY
CABLE 'A' FAILED AT 59 MONTHS
CABLE 'B' FAILED AT 7 DAYS *
CABLE 'C' FAILED AT 24 MONTHS
CABLE 'D' FAILED AT 7 DAYS *
CABLE 'E' FAILED AT 14 MONTHS
CABLE 'F' FAILED AT 8 MONTHS
CABLE 'G' FAILED AT 2 MONTHS
* FAILURE DUE TO INTERNAL CORONA CUTTING
POWER FACTOR-PERCENT
TIME AGED-MONTHS
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28
A
B
C
D
E
F
G

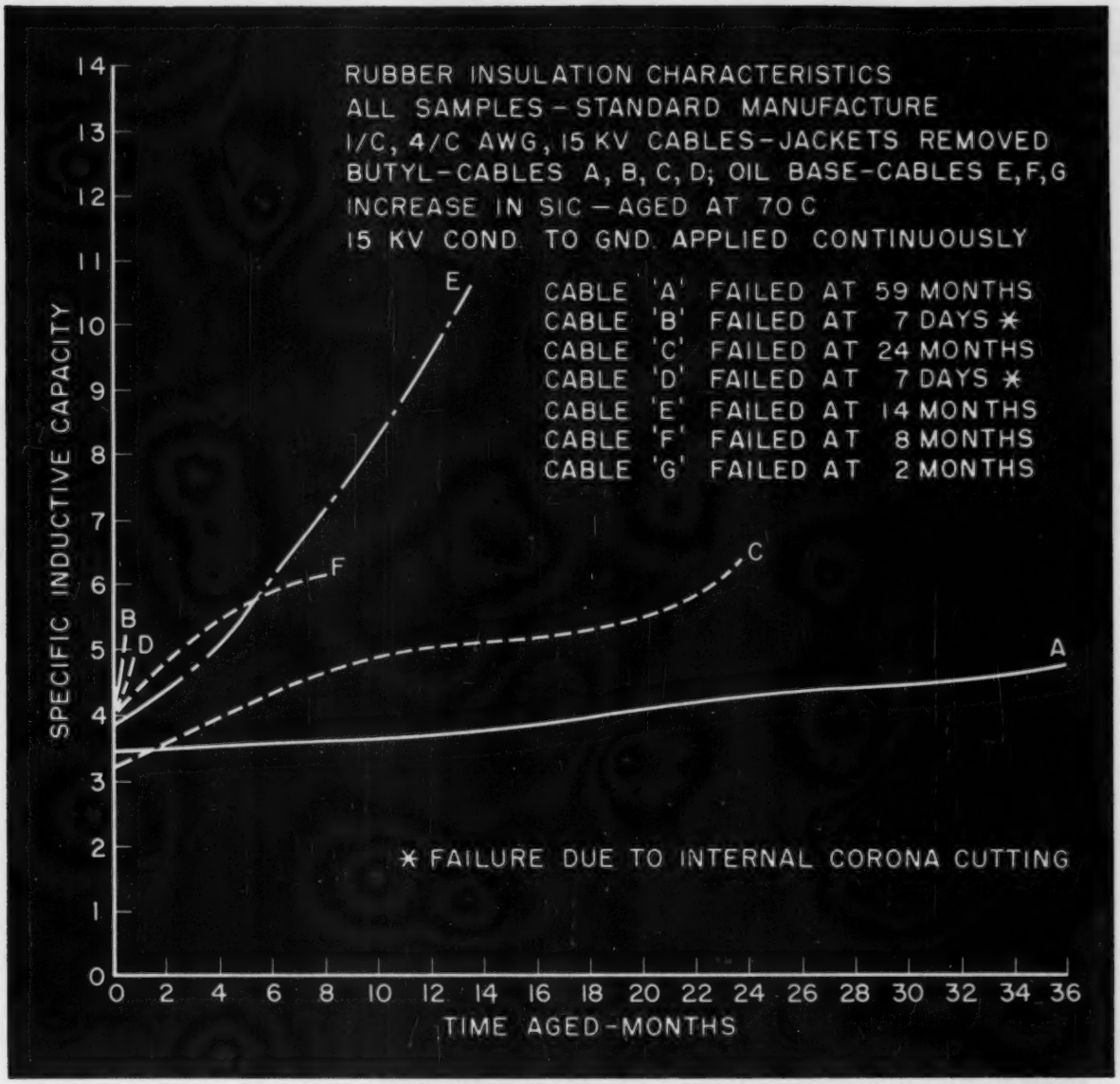
DURASHEATH LASTED TWICE AS LONG AS NEXT-BEST RUBBER CABLE. Cables were submerged in water heated to 70C, and 15000 volts conductor-to-ground applied

Anaconda

These accelerated-life tests prove

Anaconda proved the big difference in rubber insulations by buying competitive cables on the open market, taking a random sample of an Anaconda Durasheath cable out of stock, and running them all through a five-year *underwater test at 173% RATED VOLTAGE*. This extra-rugged non-standard test comes closer, on an accelerated basis, to correlating cable performance under actual operating conditions than any industry test. As you can see, Anaconda Durasheath ("A" in the chart) lasted more than twice as long as the next-best cable—59 months compared to 24 months.

Durasheath quality is the result of three factors: Superior compounds resulting from years of developmental research and constant improvement; advanced techniques of manufacture; and better ingredients. For instance, Anaconda Butyl (AB) insulation is compounded with only nonhygro-


RUBBER INSULATION CHARACTERISTICS
ALL SAMPLES – STANDARD MANUFACTURE
1/C, 4/C AWG, 15 KV CABLES – JACKETS REMOVED
BUTYL – CABLES A, B, C, D; OIL BASE – CABLES E, F, G
INCREASE IN SIC – AGED AT 70 C
15 KV COND. TO GND. APPLIED CONTINUOUSLY
CABLE 'A' FAILED AT 59 MONTHS
CABLE 'B' FAILED AT 7 DAYS *
CABLE 'C' FAILED AT 24 MONTHS
CABLE 'D' FAILED AT 7 DAYS *
CABLE 'E' FAILED AT 14 MONTHS
CABLE 'F' FAILED AT 8 MONTHS
CABLE 'G' FAILED AT 2 MONTHS
* FAILURE DUE TO INTERNAL CORONA CUTTING
SPECIFIC INDUCTIVE CAPACITY
TIME AGED-MONTHS
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36
A
B
C
D
E
F

continuously. Where other cables had failed completely, Durasheath's power factor (line A, left) had increased from 1.5 to only 7.1; SIC (line A, right) from 3.5 to 4.3.

proves it!

there is a difference in rubber insulations

scopic fillers to prevent increase in power factor by moisture absorption.

Durasheath's superiority is now further improved by a uniquely new "Uniblend" mixing process which literally homogenizes the Butyl mixture, disperses all the components thoroughly to prevent variations in the high dielectric strength of Anaconda Butyl (AB) insulation.

For more facts on Durasheath and Anaconda's new Uniblend mixing process, contact Anaconda Wire and Cable Company, 25 Broadway, New York 4, New York, Department EFL-2-EW. 61249

ASK THE MAN FROM

ANACONDA®

FOR DURASHEATH BUTYL-INSULATED CABLE

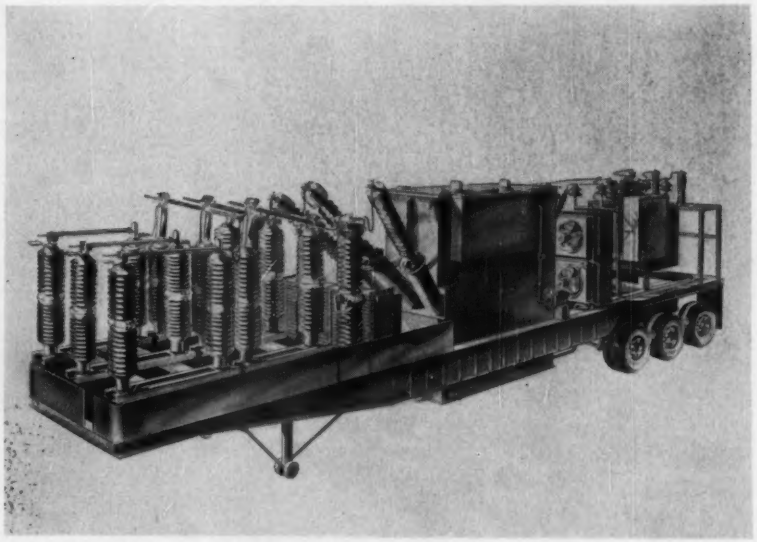
'Mobiles' Double Capacity Per Pound

Mobile substations and transformers, reportedly featuring record ratings and up to twice as much capacity within the same weight and dimensional limitations, are now being produced by the General Electric Co.

The new mobiles are said to meet utility needs for higher rated, compact units which can be used during maintenance and for back-up protection of large bulk or transmission substations.

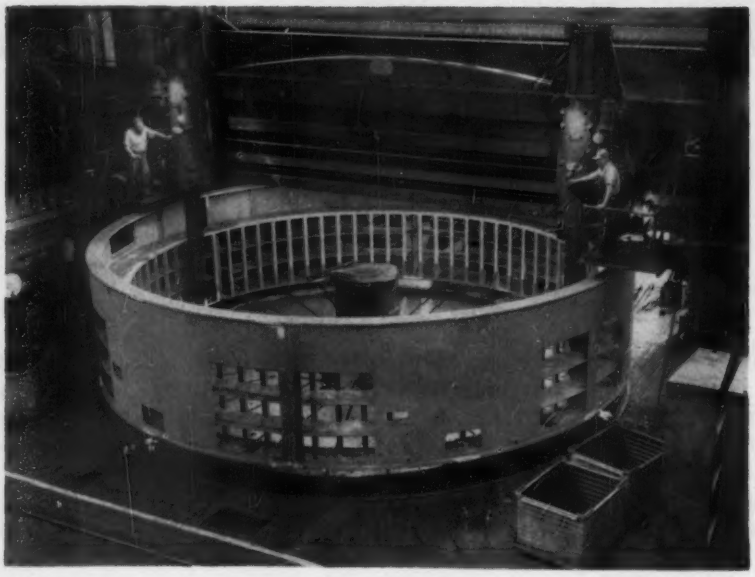
New mobile transformers have already been ordered or shipped at ratings ranging from 15,000 kva, 110 kv to a new industry high of 57,000 kva, 230 kv. New mobile substations have been ordered or shipped at 10,000 kva, 69 kv to 25,000 kva, 138 kv. The new design permits even higher ratings without impairing the mobility function, according to engineers at G.E.'s power transformer department, Pittsfield, Mass.

Patented Permalex transformer insulation and certain proprietary design innovations are said to have accounted for a large share of the increase in capacity, without increase in unit size or reduction in normal life expectancy. Further, it is reported that an even more significant increase in capacity has been achieved through reduced BIL (basic impulse insulation level). The insulation levels have been reduced by efficient coordination of advanced transformer design and improved lightning arrester characteristics, the engineers said.



20,000-KVA, 110-KV MOBILE SUBSTATION, by GE, has the same size and weight as a unit having but half the electrical power capacity, built 3 yr ago

Pump-Storage Stator Yoke Is Machined



The vertical synchronous generator stator yoke for a reversible pump-turbine, matching the world's largest now in operation, is now being machined on a 40-ft vertical boring mill at Allis-Chalmers Manufacturing Co's West Allis (Wis.) Works.

The yoke is one of two for reversible generator-motors rated 101,500 hp at 105.9 rpm, 95% pf, 13.5 kv as a motor, and 69,500 kva, 95% pf, 13.8 kv as a generator, to be shipped in mid-1962 to Appalachian Power Co for a double-dam project near Smith Mountain on the Roanoke River below the city of Roanoke.

The pump-turbines will have a rated capacity of 87,000 hp at 180-ft net head when generating and 1,400 cfs at 197-ft total dynamic head when pumping.

CHANCE CLAMPS

ARE DESIGNED WITH CONDUCTOR IN MIND

there's a Chance clamp for every conductor material . . . every conductor size

The first step in making a good line connection is to select the right clamp for the type connection to be made. Sometimes it's a not-so-simple step, for operating conditions change continually, and you've got to be sure the clamp you choose has been developed to meet a particular requirement.

That's why it pays to select Chance hot line clamps. For Chance engineers dig much deeper—go much further than you would probably think necessary—to develop hot line clamps.

Chance clamp engineers have been "digging deeper" for 28 years now. They've picked up a lot of skills and experience in that time. They are clamp experts . . . *creative designers* who have contributed such clamp innovations as T-type terminals, aluminum body clamps, compensation for line vibration, and control deflection of the eyescrew.

This creativity in design is one good reason why Chance is the world's largest producer of hot line clamps. It's the very best reason why you'll find the clamp you need for copper to copper, aluminum to aluminum, and general purpose connections in the complete Chance tap clamp line. And they're available individually packaged in plastic bags with Chance z.l.n. 100 Contact Aid already applied.

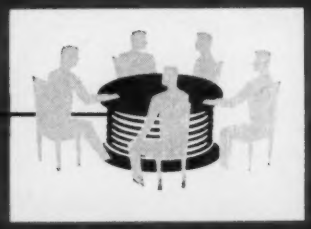
Ask your Chance Man about the operating benefits that are engineered into each Chance clamp. He has the full story, and he'll help you select the right clamps for your applications.

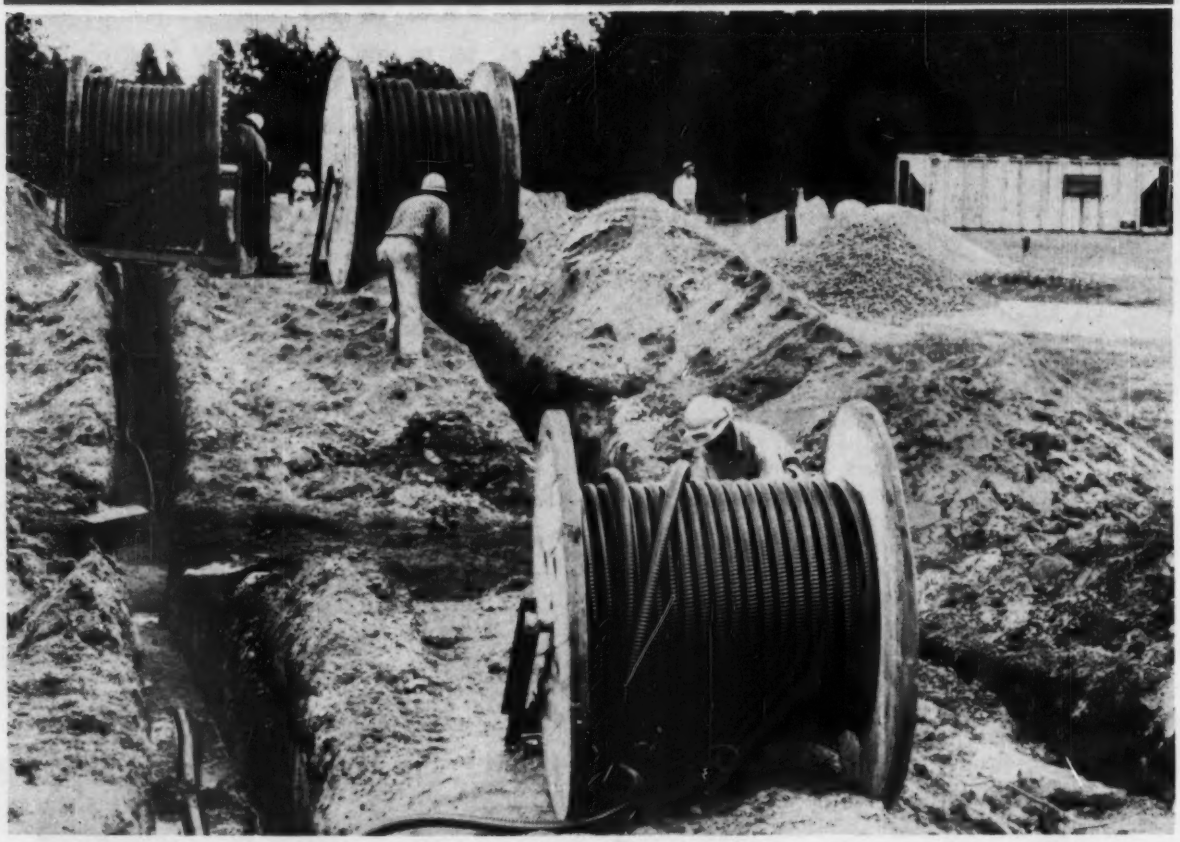
A.B. CHANCE CO.
CENTRALIA, MISSOURI
A. B. Chance Company of Canada, Ltd. Toronto

CC61-13

DU PONT

WIRE AND CABLE ROUND TABLE





Easily installed 15 KV Simplex C-L-X cable utilizes insulation and jacketing of ALATHON®

Du Pont ALATHON polyethylene resin provides the Simplex Wire & Cable Co., Cambridge, Mass., with a reliable insulating and jacketing material for their C-L-X cable.

Simplex C-L-X corrugated metallic-sheathed cable insulated and jacketed with ALATHON can be installed with clamps, in trays or ladders, or directly in the ground. It's pliable . . . can be handled smoothly . . . installs without fittings, such as benders or elbows. And it can be used anywhere.

Because of its extremely low dielectric constant (2.28) and power factor (0.0002), insulation of ALATHON 3B, NC-10 is thoroughly reliable. Its resistance to corona, at critical bend areas, is also of major importance.

As a jacket, high-molecular-weight ALATHON 1000, BK-30, offers trouble-free durability under a variety of severe environmental conditions. In direct burial installation, it is unaffected by soil chemicals, and its environmental stress crack resistance is unsurpassed by any thermoplastic. As a combination, the two compounds produce a cable of smaller dimensions with complete reliability.

Whatever your specific cable construction, the use of ALATHON almost invariably results in a lighter, more flexible cable, and one which is easier to install. A wide selection of specialized formulations of ALATHON is available to meet the electrical and environmental requirements of various installations. For more information, consult your supplier, or write: Du Pont Company, **Dept.EW-1211**, Room 2507A, Nemours Bldg., Wilmington 98, Del. *In Canada:* Du Pont of Canada Ltd., P. O. Box 660, Montreal, Que.

Du Pont does not manufacture wire and cable, but supplies thermoplastic resins to the wire and cable industry.

POLYCHEMICALS DEPARTMENT

ALATHON® POLYETHYLENE RESINS | **RULAN®** FLAME-RETARDANT PLASTICS | **ZYTEL®** NYLON RESINS

DU PONT
REG. U.S. PAT. OFF.
Better Things for Better Living . . . through Chemistry

Electromagnetic Forming Machine Is Developed

Commercial availability of the first electromagnetic metal-forming machine for industrial use was announced today by the General Atomic Division of General Dynamics Corp.

"Magneform," the new metal-working tool, employs fast bursts of electromagnetic force to assemble, attach and shape metals quickly.

Magneform applies a powerful magnetic field against a work piece of metal in pulses of 10 to 20 millionths of a second, creating pressures ranging up to more than 50,000 psi.

These pressures can be used to collapse, shrink or compress tubing, to attach terminal connections onto rope, steel, or coaxial cables, or to swage firmly together sections of telescoping tubing.

In other applications, the magnetic pressure will expand tubing to form a tight-fitting bearing, hub or bushing. Since it is never necessary to bring the work piece into physical contact with the coil producing the magnetic field, Magneform is said to eliminate scratching, marring and other surface damage.

Compact Power Supply System Developed For Computer

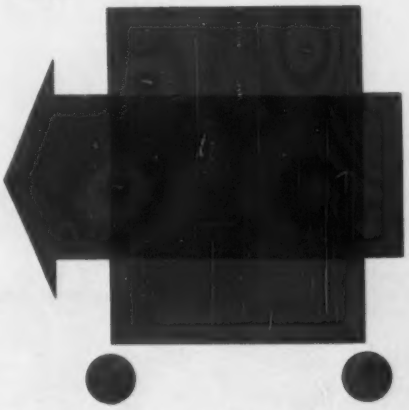
Development of a compact and highly precise power supply system for the Radio Corp of America's new 601 computer was announced recently by Airpax Electronics, Inc.

Unlike conventional power supplies, it is a system which uses transistor-driven magnetic amplifiers to regulate six critical voltage levels for the computer to within as little as three-fourths of 1% of rated output, reportedly even under severe variations of line voltage and output loads.

Engineers at Airpax, an electronics firm with headquarters in Fort Lauderdale, Fla., said the 601 power supply system is the first of its size to handle a total load of 13 kw with its precise regulation of each power level supplied.

Development of the compact power supply systems, each of which

A Westinghouse Metal-Clad Switchgear advantage to you:
Horizontal drawout construction of DH breakers makes inspection, maintenance and replacement quick and easy



For complete facts on Westinghouse metal-clad switchgear using DH magnetic air circuit breakers, contact your Westinghouse representative or write to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.
You can be sure . . . if it's **Westinghouse**
J-61022

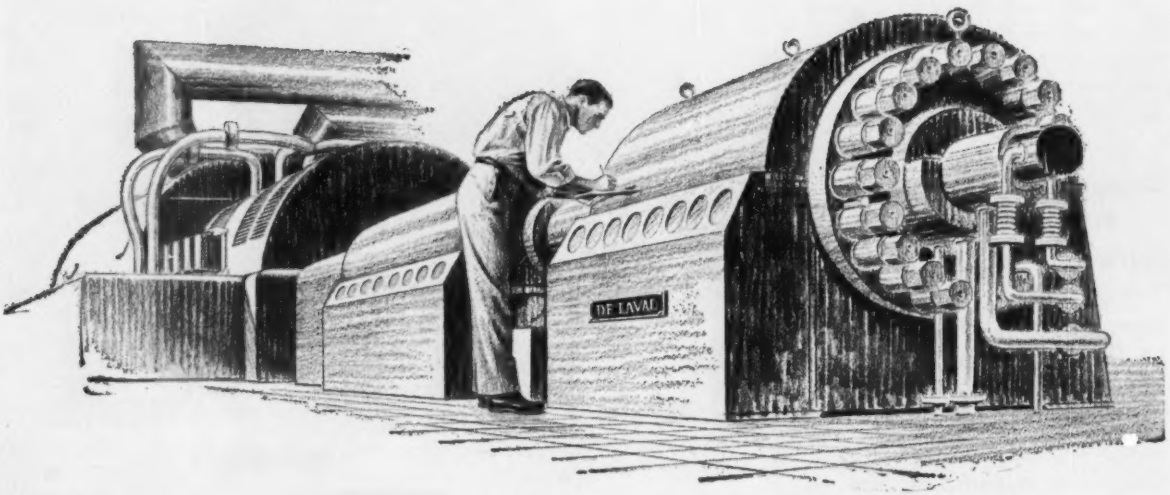
DE LAVAL

engineering ingenuity means low-cost feed for giant boilers

Electricity remains "America's biggest bargain" because of the applied engineering ingenuity of the nation's electric utilities and their suppliers. Case in point: the planned installation of high-capacity De Laval boiler-feed pumps at a prominent utility. For the first time in a U. S. utility, boiler-feed pumps will be driven through the governor end of the main steam turbine-generator. Costly energy-conversion processes will be eliminated; more electricity will be available for sale. The utilities will gain another tool in their continuing effort to hold the line on cost.

Whether you have giant boilers to feed, or other problems involving rotating machinery, De Laval engineering ingenuity can help.

De Laval Steam Turbine Company, Trenton 2, N. J.



MG-DL-119

DE LAVAL • 60 YEARS OF CREATIVITY AND QUALITY

CENTRIFUGAL PUMPS AND COMPRESSORS • TURBINES • IMO® ROTARY PUMPS AND HYDRAULIC MOTORS
MARINE PROPULSION AND AUXILIARY EQUIPMENT • HELICAL AND EPICYCLIC GEARS • TURBOCHARGERS

costs about $25,000, marks the entry of Airpax into the expanding field of power suppliers for large computers and similar equipment.

Line voltage can change as much as 15% above or below nominal. Output current on one voltage can change by 80 amp, as a step function with a rise time of 50 μsec.

The six voltages are adjustable to 0.05 per cent accuracy under any condition of input voltage and output current. All circuits are fully protected against the possibility of excessive output voltage or current.

Lower Prices, Higher Properties Now Listed for Class H Rod

Improved property values are now listed by the manufacturer for Glastic "VITAC" insulating Class H rod stock material.

The rod stock combines Fiberglas reinforcement with a new high-temperature resin system. It is engineered for duct spacer sticks in Class H dry-type transformers and other insulating-structural applications calling for 180C.

When the product was first announced by Glastic Corp early in 1961, conservative values were placed on all properties. Continued testing reportedly allows the manufacturer now to list the following higher properties:

Flexural strength	Present psi	Former psi
As received	50,000	25,000
After 200 hr at 250C	45,000	25,000

Other test results show flexural strength after 100 hr at 296C, to be 30,000 psi, 60% of the as-received value.

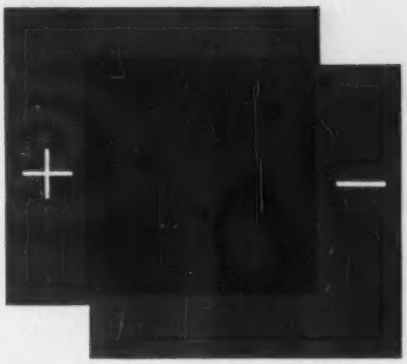
Flexural strength "as received" is said to be 2½ times that of silicone rod, "after 200 hr at 250C," 2¼ times. It is further reported that compressive strength after 200 hr at 250C is up to three times that of silicone, while other properties equal or exceed those of silicone.

The rod is available from the Cleveland firm in 4-ft lengths, in six sizes, from ¼ x ¼ in. to ½ x ¾ in.

(*More News of Manufacturers, p* 87)

A Westinghouse Metal-Clad Switchgear advantage to you:

Limitrak* insulation system provides superior, balanced protection



For complete facts on the total Limitrak insulation system used in metal-clad switchgear, contact your Westinghouse representative or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.
You can be sure . . . if it's **Westinghouse**
*Trademark
J-61023

BODY BY FISHER ROOMINESS

is another reason Chevrolet does better by your fleet dollars

[*right up through trade-in time*]

★★★★★★★★★★★★★★★★★★★★

This new Chevrolet gives you the man-sized, down-to-business roominess you want in a fleet car. In fact, Chevrolet went to the extent of using lifelike models to make certain all its '62 models have space to spare, wherever it counts, for relaxing comfort. That goes for head room, leg room, foot room—the works. Those big wide-opening doors are another Body by Fisher advantage for busy fleet schedules. And what Chevrolet does for people, it does for luggage. Nobody else in Chevrolet's field gives you a trunk like this one, with bumper-level loading plus a deep-well floor that lets you take aboard odd-shaped objects other cars just can't accommodate. Add to this all the traditional Body by Fisher advantages—its rugged durability, handsome hardy interiors, through and through insulation against road noise and weather—and you have some of the best reasons why Chevrolet keeps its value longer to bring top trade-in year after year. . . . Chevrolet Division of General Motors, Detroit 2, Mich.

Low-sill trunk design takes lift out of loading. Extra-wide lid allows easy loading from the side.

Foam-cushioned front seat, front arm rests, dual sun visors, cigarette lighter and glove box lock are standard on all '62 Chevrolet models.

'62 CHEVROLET

CHEVROLET

MANUFACTURERS BRIEFS

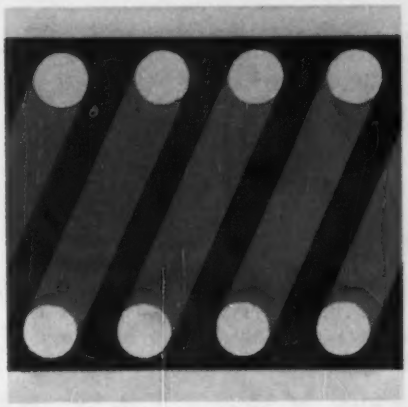
• **International Electric Corp** will open a $3.5-million data-processing center at Paramus, N. J., which will provide services in programing, operations research, system analysis and sale of computer time. Michael J. Samek has been appointed as director and will be assisted by 250 programmers and analysts. The center will have a 7090 computer and two 1401 systems. The computer will be rented for periods of one tenth of an hour, or as long as required. Systems analysis and design, programing, and debugging service will be provided.

• **General Electric Co** has been selected by **Minneapolis-Honeywell Regulator Co** to supply the nuclear monitoring system and reactor safety system for the Atomic Energy Commission's experimental gas-cooled reactor at Oak Ridge, Tenn. The G-E designed instrumentation will supply continuous data on reactor power level for startup and operation of the plant, providing for rapid automatic shutdown of the reactor if the power level or other process measurements exceed permissible limits.

• **Lasco Industries,** Montabello, Calif., plans to set up national distribution of its recently introduced plastic electrical conduit line. Lasco's line of rigid polyvinyl chloride pipe, elbows, couplings and adapters, ranging in size from ½ to 6-in. dia, was approved and listed for underground application by Underwriters' Laboratories, Inc, last August. Production is now being stepped up to work off an initial order backlog.

• **Federal Pacific Electric Co** has a new Speed Order Service Panelboard Assembly Operation in its new Des Plaines plant which provides 24-hr delivery of the company's line of panelboard equipment to the Chicago metropolitan electrical industry. This new facility and its counterparts in major cities throughout the US are an integral part of its efficient system of warehousing and distribution, says FPE. The company believes these facilities have played a major role in sales growth—from $8.5 million in 1950 to better than $100 million in 1960.

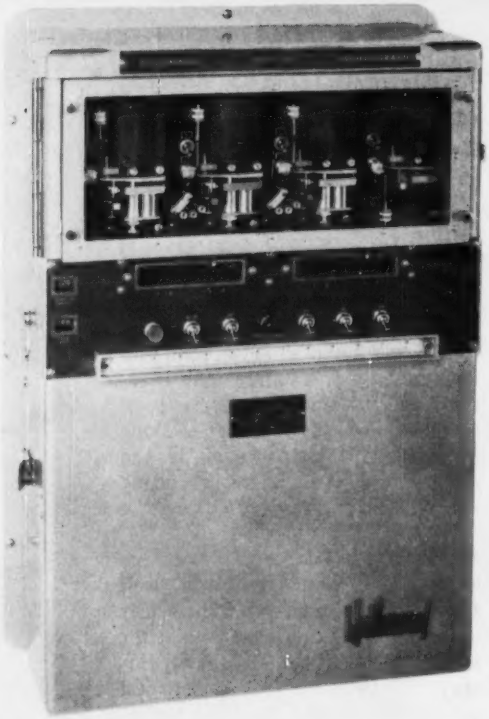
A Westinghouse V-2 Disconnecting Switch advantage to you:
Totally-enclosed counterbalancing mechanism rides on almost frictionless Delrin rollers — provides proper blade balance in any mounting position, under all conditions



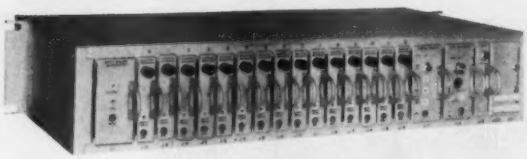
For complete facts on V-2 disconnecting switches, contact your Westinghouse representative or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.
You can be sure . . . if it's **Westinghouse**
J-61024

New Equipment

Oscillograph Recorder . . .



. . . has electronic flash time unit which monitors and records fault conditions at critical points of the power system. The RS-9 (30) B oscillograph, with 32 channels, has a simplified automatic recording lamp-changing mechanism to preclude loss of recording lamps during periods of standby and record. The unit has a larger synchronous motor using a slow-moving cam with chain drive to advance the hour, minute and second wheels of the digital readout. Low-speed operation is said to increase the life expectancy of the assembly. An internal, thermostatically controlled blower has been added to pressurize the oscillograph case, prolong the life of component parts by limiting their operating temperature. The OA-4 high-frequency recording galvanometers with which the unit is equipped are fitted with jeweled suspension, silicone damping.
Hathaway Denver, 5800 E Jewell Ave, Denver 22, Colo.

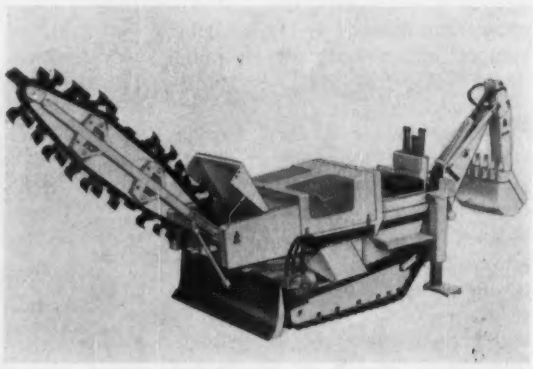


Alarm System . . .

. . . senses and reports faults from unattended microwave stations. The FA-102 system consists of a transmitter card cage assembly (shown here) and a receiver card cage assembly—each 3½ in. high, 8 in. deep—which mount on a standard 19-in. rack. Plug-in, 12-contact, etched wiring cards contain all active circuits, controls and semiconductors. Similarity of components allows interchangeability of most cards between units. One transmitter is used at each fault-sensing location and the receivers (one for each transmitter) are assembled on a rack at the master control station. Power requirements for the transmitter and receiver are: 24 v, ±5%, dc, 1 amp, maximum. Standard fault positions are 11 faults per cage, with 7, 11, or 19 faults available if required.
Alpha Corp, Div of Collins Radio Co, Dallas, Tex.

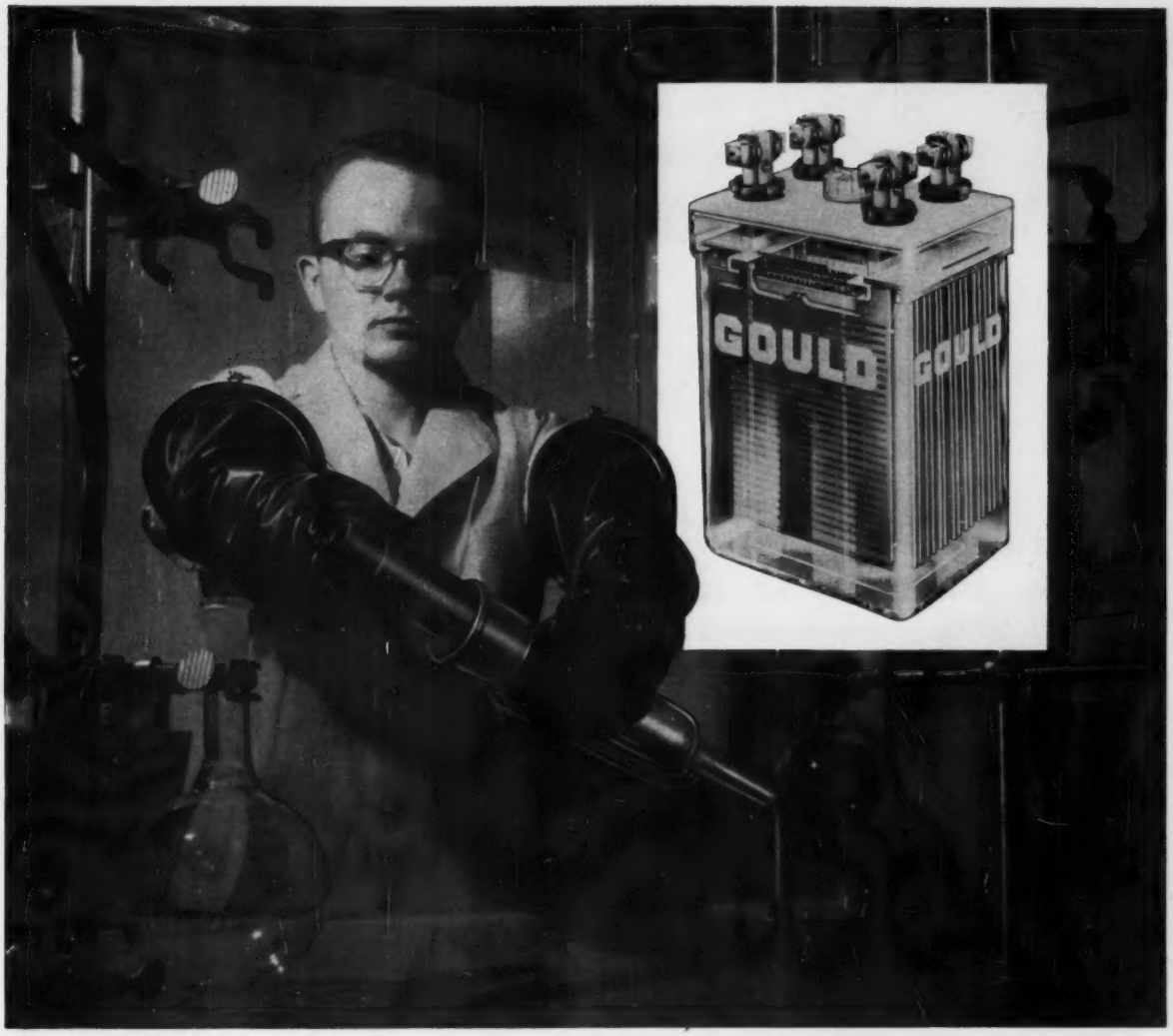
Trencher/Dozer with Backhoe

. . . for all-purpose excavating and leveling, is said to be capable of handling every soil condition and every trenching, digging and ditching assignment from 3 in. to 36 in. wide to 100 in. deep. The T-78 trencher (with integrated dozer) trenches to speeds up to 840 ft per hr, and the D-100 backhoe attachment takes over excavations and trenching in extremely rocky areas which no trencher can touch. The D-100, which operates off the T-78's hydraulic system, is said to have power and speed equivalent to larger makes. Pryout power is in excess of 10,000 lb and it has a 180-deg continuous operating arc. With boom fully extended, lifting capacity is 1,000 lb. Backhoe digs 8 ft, 4 in. deep, has buckets from 12 to 36 in. wide. Measuring only 37 in. wide (with belt conveyor and dozer extensions removed) the machine has ground-gripping traction but is balanced for high flotation, has minimum ground pressure, so that it may be used on soft ground.



Davis Mfg, Inc, 1500 S McLean Blvd, Wichita 13, Kans.

(*More New Equipment, page* 92)



REACHING FOR THE UNKNOWN TO GIVE YOU MORE BATTERY POWER

In this atmosphere control chamber at the Gould-National Battery Research Center, scientists perform delicate tests to extract unknown elements from battery raw material.

It's just one of the many steps taken by Gould in their constant search for improvement . . . and is good reason why Gould offers you top battery power and performance—plus the newest designs for tomorrow's exacting battery requirements.

Gould stationary batteries are available in Plante, Calcium and Kathanode® types. Gould field engineers are ready to assist you in battery application and maintenance procedures.

CHARGERS—Ask about Gould's new line of specially engineered stationary charging equipment: float, filtered and unfiltered.

Write for detailed information, or call your local Gould office listed in the Yellow Pages under "Batteries, Industrial." Sales offices and agents in continental United States and overseas.

NEW Gould Rechargeable Flashlight and Lantern Batteries

Of nickel-cadmium construction, these batteries can be recharged to full capacity over 250 times . . . and each cycle gives 50% more continuous, bright light than ordinary cells. Ask for free literature.

More Power to you from GOULD®

GOULD-NATIONAL BATTERIES, INC. GN

INDUSTRIAL BATTERY DIVISION

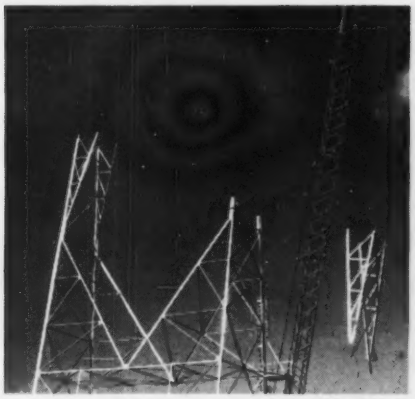
GOULD-NATIONAL BATTERIES, INC.

St. Paul 1, Minnesota

HILLER 12E
N53

From Crossarms to Complete Towers...

Alcoa® Aluminum. Dropped from the air or built straight up. ■ Designed and fabricated by Alcoa Structural Division for economy — speed — strength.



Write:
Aluminum Company of America
Structural Division
871-M Alcoa Building
Pittsburgh 19,
Pennsylvania

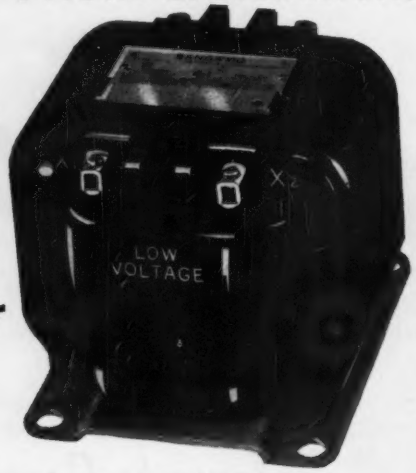
ALCOA ALUMINUM

STRUCTURAL DIVISION

Entertainment at Its Best . . . **ALCOA PREMIERE**
with Fred Astaire as Host . . . Tuesday Evenings, ABC-TV

AVAILABLE NOW FROM SANGAMO...

the smallest, lightest potential transformer of its kind

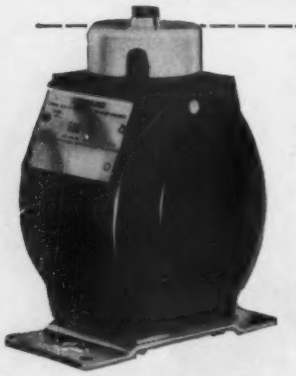


First the BH-6 current transformer . . . and now, a companion potential transformer—the T-6. Compact, epoxy-molded and encapsulated for indoor-outdoor 600 volt class service. Accuracy classification is 0.3 at W and X burdens; actually, the design allows 0.3 accuracy for burdens of two watthour meters, phase-shifting transformer, and demand register (approximately 35 volt amperes).

Impulse level of the T-6 is well in excess of 10 kv full wave, yet it weighs less than 14½ pounds. Liberal cross-section in the secondary winding accounts for a thermal burden rating of 500 volt amperes at 30°C ambient.

The T-6 is small. It measures only 5¾" x 5¼" x 4½". Standard ratios are completely color-coded as follows: 2:1, red, 2.5:1, yellow, 4:1, blue, 5:1, gray. It's built to last, too . . . right down to its alondined and painted aluminum base. Naturally, it meets all of the applicable NEMA standards for indoor transformers of the 600 volt class.

Our suggestion: check full particulars of the T-6 with your Sangamo Representative.



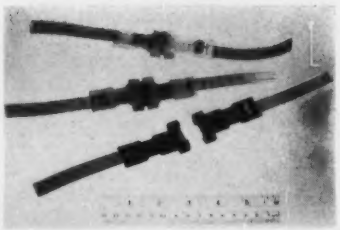
Sangamo BH-6 current transformers lead their class, too. Use them . . . take full advantage of their dual-range feature (a Sangamo first). Eliminate transformer changeouts due to load growth.

BH-6 transformers are epoxy-molded, color-coded, completely encapsulated, lightweight. Large conductor goes through that *Big Hole* easily. Available for all indoor or outdoor applications in a rating for your specific need.

SANGAMO ELECTRIC COMPANY

PX61-1

SPRINGFIELD, ILLINOIS

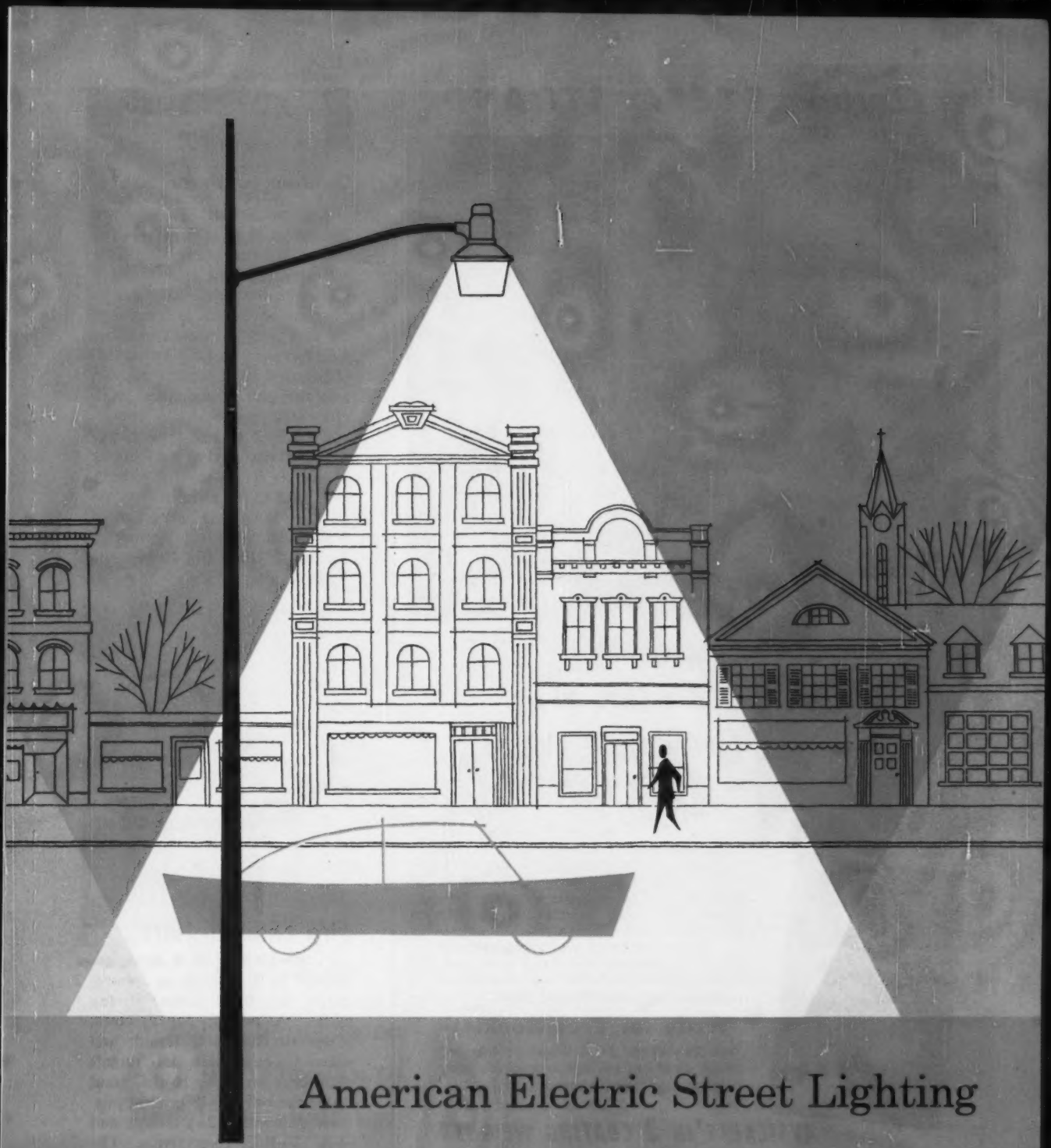


Connectors . . .

. . . for low-voltage control systems are capable of connecting three and five-conductor flat cable, will also inter-connect flat cable to conventional round wires. The Pos-E-Flex line of connectors reportedly can be installed in 30% of the time required for conventional wiring, saves up to 90% in space and weight in some applications. The kit contains connectors, cables and special application tools.
Thomas & Betts Co, Elizabeth 1, N. J.

Conductor Cable . . .

. . . aluminum, compressed-strand type, has 10% smaller diameter than other ACSR cables of the same capacity, 1,468 MCM which is said to give it much greater safety factor in withstanding wind loads. The patented Compresto process compresses 36 circular-shaped cable strands around a steel reinforcing wire into segmented shapes which reportedly fill the voids present in ordinary standard conductor cable. It has a cross-section area of 1,468,000 circular mills, a maximum design load of 6,500 lb and an ultimate breaking strength of about 30,000 lb, a dc resistance of 20C of 0.01168 ohms per 1,000 ft. Cable weighs 1,494 lb per 1,000 ft.
Olin Mathieson Chemical Corp, Chattanooga, Tenn.
(*More New Equipment, p* 94)



American Electric Street Lighting

MANUFACTURED TO STANDARDS OF EXTRAORDINARY QUALITY

Lighting technology is our special science. We apply it with painstaking skill to the design of fixtures and controls that meet the efficiency and dependability requirements of engineering departments . . . and bring smiles to cost-conscious purchasing departments. Only the finest components go into American Electric fixtures: Holophane glass, spun aluminum reflectors, cast aluminum heads. But mere materials are not sufficient to produce superior equipment. Our insistence on the best engineering, manufacturing and testing procedures does make American Electric equipment different, and better. Test it yourself. Just write:

American Electric Manufacturing Corp., 3271 Chelsea, Memphis 8, Tenn., Representatives throughout the U. S.

Crapo GALVANIZED

STEEL STRAND

Checked and Double-Checked by Laboratory Technicians

Every coil of wire used in the manufacture of *Crapo* Galvanized Steel Strand is tested and approved by trained laboratory technicians. Samples from both ends of each individual coil are subjected to a series of prescribed tests before stranding. Then, the finished strand is re-checked to make certain that it conforms in every respect to established specifications and our own high quality standards.

Thus you know when you specify *Crapo* Galvanized Strand that every precaution has been taken to assure maximum performance in the finished product.

Write for Free Booklet

"The Story Behind Crapo Galvanized Wire and Strand" illustrating and describing manufacturing techniques and testing procedures. Ask for Booklet B-59!

AVAILABLE IN 3 COATING WEIGHTS

FOR GUYS, MESSENGER AND OVERHEAD-GROUND WIRE

Crapo Steel Strand is available in all standard sizes and grades and in Class A, B and C galvanized coatings. Class B coating is twice as heavy as Class A coating; Class C coating is three times as heavy.

*Determines ductility of wire and adherent quality of galvanizing.

INDIANA STEEL & WIRE CO., INC.
Muncie, Indiana

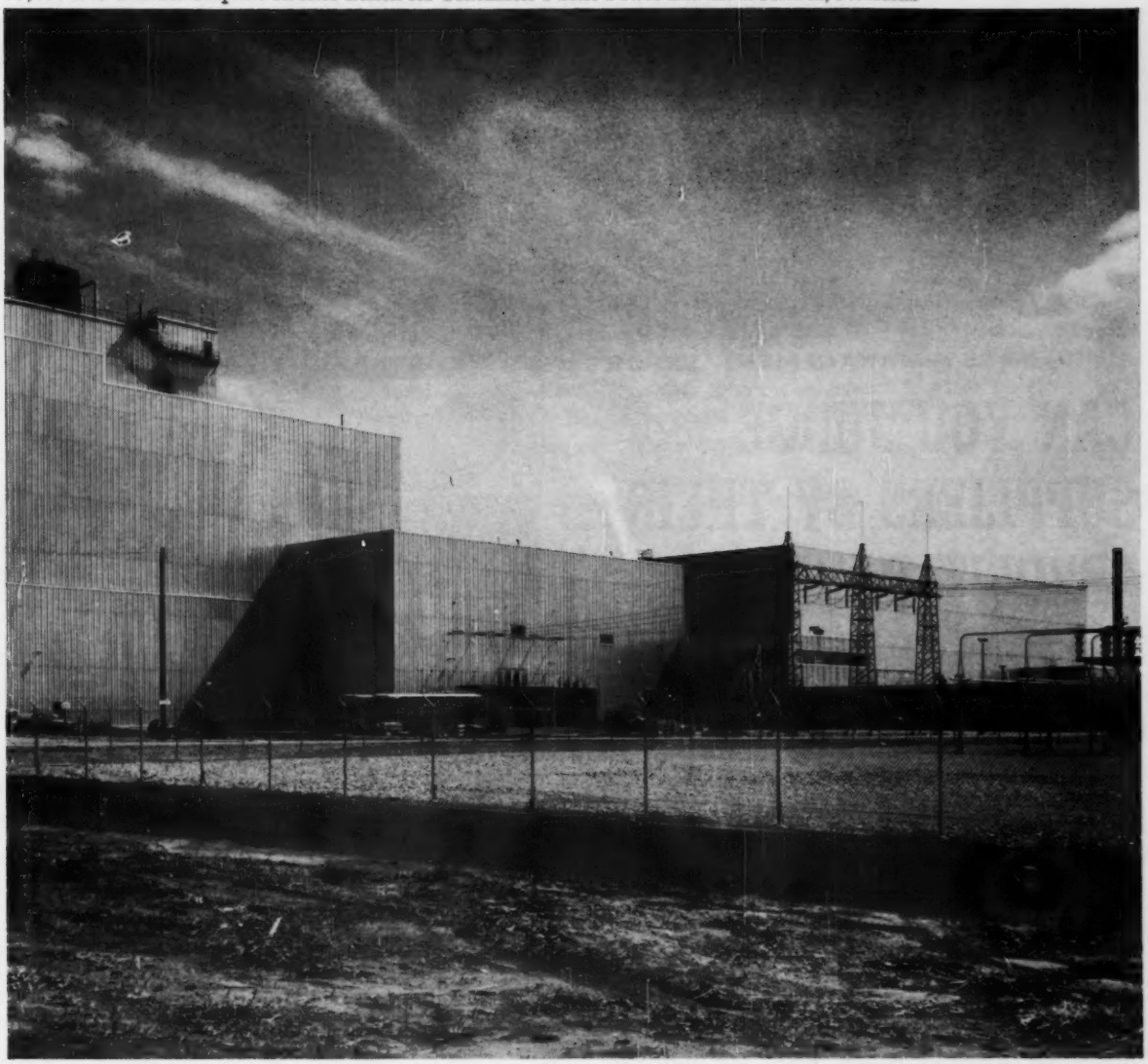
Outdoor Luminaire . . .

. . . fluorescent, gives 6,900 lumens of light at 150 W. The PMF-104B unit employs a single 4-ft Powergroove lamp which features a shatter-resistant acrylic plastic globe. This is hinged on the street side or latched at house side for easy access. An adjustable wood-pole bracket is built into the unit. Luminaire, available with photoelectric control and built-in locking-type receptacle, is designed for mounting about 20 ft above the ground. It is said to be effective for use in "private lighting" programs or for residential street lighting.
General Electric Co, Henderson, N. C.

Fire Extinguishers . . .

. . . are 10 and 20-lb units, approved by Underwriters Laboratories for three kinds of fire (Class A: wood, paper, cloth; Class B: flammable liquid; and Class C: electrical). UL ratings they bear are 2-A, 16-B:C (said to be the only 10-lb general purpose unit with a 2-A rating), and 3-A, 20-B:C, respectively. The Tri-Class-ABC portable units, approved for non-metallic fire hazards are reportedly simple to operate and recharge. Powerful, non-turbulent powder discharge is said to assure effective fire fighting. Extinguishers are also approved by Factory Mutual Laboratories.
Walter Kidde & Co, Inc, Belleville 9, N. J.

75,000 KW Sodium Graphite Reactor station for Consumers Public Power District at Hallam, Nebraska



The Peaceful Atom

What is being done in Nebraska to meet the challenge of the future

The challenge for the world's power-producing companies is to double the supply of electricity every ten years. The peaceful atom is helping to meet this goal. Already, farsighted electric utilities are making use of this fuel of the future.

An example of this provident planning is the nuclear power station near Hallam, Nebraska. It is one of the world's most advanced atomic power stations. The sodium graphite reactor is being built by Atomics International for the Atomic Energy Commission and will be operated by Consumers Public Power District. The station is scheduled to go into operation soon.

Atomics International, with over 15 years experience in designing, constructing, and operating reactors, will help the world's power producing companies double their supply of electricity by 1971.

ATOMICS INTERNATIONAL

Division of North American Aviation

Pioneers in the creative use of the atom

World Headquarters: Canoga Park, California, U.S.A. Cable Address: ATOMICS. *Other Offices:* Washington, D.C., U.S.A.; Geneva, Switzerland. *Affiliated with:* INTERATOM, Bensberg/Cologne, Federal Republic of Germany and DYNATOM, Paris, France.

OHIO BRASS MANAGEMENT REPORT

CAN YOU JUDGE SUPPLIERS BY THEIR "PROFIT HABITS"?

BY GEORGE L. DRAFFAN
CHAIRMAN, OHIO BRASS COMPANY

One measure of a person's importance is the amount of advice that's directed at him. By this measure among others, the purchasing agent is one of the top people in our industry. With so much advice pouring his way, I hope he won't mind a little from me... much like the advice that I ask our purchasing people to consider when we discuss ways of judging a supplier.

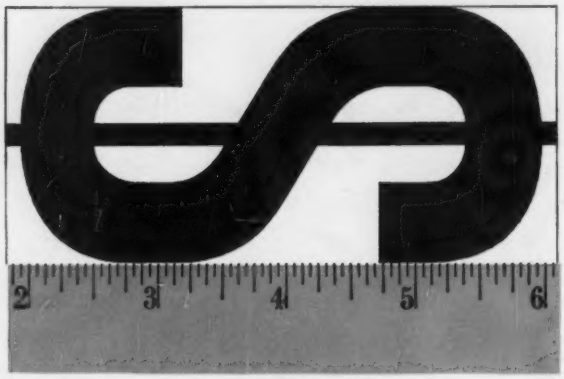
I BELIEVE THAT A SOUND JUDGMENT can be made on the basis of the answer to one question: "Does the supplier's company have the profit habit?" If his company's economic history indicates the habit of making a profit is well established, we can safely make certain assumptions about the supplier's qualifications.

FIRST, we can assume that he will be available when we need him... to service products and to supply more like them.

SECOND, we can expect product improvements, both through addition of more efficient production facilities and through a substantial investment in orderly research and development.

THIRD, we can assume that facilities and qualified personnel will be available for special problems that call for engineering counsel or special testing.

FOURTH, we can expect his employees to be enthusiastic and productive.



FIFTH, we can assume that his company and his employees contribute beyond any commercial consideration to their industry and to their communities... providing scholarship programs, working to raise industry standards, helping their communities become better places to live.

YOU PROBABLY REALIZE by now where this list comes from. It comes from the experience of our company and what we have been able to offer customers because we usually make a profit. However, the present profit position must be improved if we are to continue to perform as our customers expect.

WE ARE MAKING DEFINITE MOVES to increase profit. We hope they succeed. We want to offer customers more services and product improvements. They can come only from a company that has the profit habit. At the moment we are highly optimistic both about the future of our industry and about our company's ability to serve it... at a profit.

10159.H

OHIO BRASS COMPANY, MANSFIELD, OHIO
Porcelain Insulators – Line Hardware – Capacitors – Lightning Arresters Bushings – Holan Truck-Mounted Power Devices and Bodies – Bronze Valves

Electrical World

DECEMBER 11, 1961

Management Newsletter

Editor's Note: Since the electrical equipment antitrust investigations began, it has become ever more difficult to get, for publication, objective material on the working fundamentals of this particular marketplace. Yet, such material has never been needed so badly. If the market is to return to the healthy state required for continued growth of the industry, mutual understanding among manufacturers, users, and government must be enhanced. There can be little understanding without discussion. And with many normal communications channels restricted or blocked by advice of counsel, we feel the printed page to be one of the better media left open for such discussion.

Thus *Electrical World* has devoted more Management Newsletter space to this subject during 1961 than to any other subject except finance or business conditions. During the coming months, we will be presenting a stepped-up program, illuminating further the various facets of this marketplace. We hope these upcoming Newsletters will provoke thought and discussion that in turn will provide more material, whether attributable to some individual or company, or not. We need not "agree" with a view to print it; the criteria here are objectivity, validity and thought stimulation. From time to time we'll express our own views, and clearly label them as such.

We have chosen this week an article which first appeared in the November issue of *The Atlantic Monthly,* entitled "Are Big Businessmen Crooks?" Written by Leland Hazard, Pittsburgh lawyer, teacher, and civic leader, it discusses the Sherman Antitrust Act, the "electrical conspiracy," and the relationship of profits and competition. It is reprinted here in slightly abridged form with the kind permission of Mr. Hazard and *The Atlantic Monthly.*

Are Our Antitrust Attitudes Valid?

Early in 1961 big business drew down on itself some scathing headlines. Some corporate officials of high rank, close to the top, spent 30 days (less good-behavior time) in jail for conspiring to fix prices and allocate orders among their companies. Honored names were involved, among them Westinghouse and General Electric. This was the first time in 70 years that any American big businessman had been incarcerated for violation of the 1890 Sherman Antitrust Act.

That the crimes were committed, there is not a scintilla of doubt. Under the law there were no extenuating circumstances. The guilt was stark. According to most of the editorial writers, the sentences said to businessmen: Compete or go to jail. Judge J. Cullen Ganey, in Philadelphia federal court, said, "What is really at stake here is the survival of the kind of economy under which this country has grown great, the free-enterprise system." That was it—our system had been betrayed.

But a paradox haunts the scene. The crimes seem horrendous. Yet the Attorneys General of the United States and the American courts waited almost three quarters of a century to impose on big businessmen the criminal sanctions which have been in the Sherman Antitrust Act since 1890. This fact must give us some pause.

There are two famous sections of the act. The first enjoins conspiracy in restraint of trade, and the second forbids monopoly. These basic provisions have remained unaltered since the day in President Harrison's Administration when the law, with a mini-

Condensed from Nov. 1961 issue of The Atlantic Monthly, ©Copyright 1961, The Atlantic Monthly magazine. Reprints of unabridged article available from The Atlantic Monthly, Reprint Section, 8 Arlington St, Boston, 16, Mass.

mum of debate, was first passed. These are the sections under which Theodore Roosevelt, through his Attorney General, induced the Supreme Court, in 1904, to break up J. P. Morgan's Northern Securities Company, a railroad empire; under which John D. Rockefeller's Standard Oil Company of New Jersey, in 1911, was fragmented; and under which the Aluminum Co of America, in 1945, was held, despite the absence of predatory activity, to be an unlawful monopoly. In these and many other great cases, the object has been to restore or create competition.

To enforce competition the Sherman Act gives the government a two-edged sword: one, the injunction, which can reach into the most time-honored practices to assert the law's will; the other, criminal punishment for the offense of non-competition or monopoly, which the Sherman Act designates a misdemeanor, providing up to a year's imprisonment or a fine or both. The facts in Mr. Morgan's case, in Mr. Rockefeller's and in Alcoa's could have been used by the government to press for the criminal penalty as well as for the civil injunction. John D. Rockefeller could have gone to jail. But the ultimate punishment was not imposed until just now.

It was not that the act had become a blue law. Far from it. In the first 70 years of the Sherman Act, there were 1580 antitrust cases, two thirds of them since 1940. Often the government has used the criminal (grand jury) process to get facts, only to seek injunction on the civil side. Often the government has pressed criminal cases through to a fine. But seven decades rolled away before seven highly placed business executives served time in a federal penitentiary.

Adam Smith's Thesis

If there is something about competition so vital to our welfare that the men who serve the free-enterprise system must go to jail for not competing, we must examine the premise.

William James said: "The truth of an idea is not a stagnant property inherent in it. Truth happens to be an idea. It *becomes* true, is made true by events: its verity *is* in fact an event, a process: the process namely of its verifying itself. . . ." Our American philosophy bids us test every dogma by its results—the dogma of competition no less than any other.

The term "free enterprise" embraces an economic system which was first comprehensively articulated by the Scottish philosopher Adam Smith in *The Wealth of Nations*, 1776. Competition lies at the heart of Smith's analysis. In his economic scheme he assumes an aggressive, predatory, selfish nature in man. But, he explains, man's aggressions are neutralized in a marvelous mechanism called the market place, where the consumer bestows the favor of purchase upon the most competitive seller; or the worker, the favor of his services upon the highest bidder for labor. Competition does the trick. If prices of goods are high, the urge for profit will bring in more producers, and competition will bring the prices down. If wages are high, the ensuing well-being of the workers will increase population, and competition for jobs will bring wages down. Everybody pursues avidly his own selfish interests, but the self-regulating market place forestalls the evils of individual success. Hence, a good society ensues from the selfish pursuits of individual men.

Even Adam Smith applied a mystical term to his market place: "the hidden hand." But his thesis, product of the Age of Reason, had great appeal. Men long intimidated by taboos, priesthoods, fear of hell felt themselves emancipated. To pursue one's own selfish interest and at the same time, thanks to the market place, serve society well—this was a new idea. Americans liked it. It fitted the pattern of escape from too much rulership, too much dogma, too much ecclesiasticism. America was through with revealed truth; it was ready to accept what would work in the market place. Adam Smith never put it this way, but actually he had substituted the market place for God, in so far as God cares about social well-being. So, if the market place had become the god of social well-being, it must be sacrosanct.

Competition Abandoned

John D. Rockefeller, a great business manager by any standards, past or present, was the first American to tamper with the market place so successfully as to create alarm in the American people. Rockefeller, through various means, was able to gain control over the oil refining industry and monopsony power over the crude oil producers. The monopolistic impact of the Standard Oil Co eventually resulted in Congress expressing itself in favor of competition through passage of the Sherman Act in 1890.

Forty-three years later, another Congress, anguished by the Great Depression, suspended the antitrust laws *pro tanto* and invited competitors, whose lower and lower prices were producing less and less business, to agree, under the aegis of NRA, to codes of business conduct which fixed practices and sometimes prices. In our country's darkest economic hour we abandoned competition. Franklin Roosevelt in a fireside chat castigated "chiselers" (competitors). Frederick Lewis Allen, writing in *The Big Change*, put it bluntly:

"In short, while the New Deal did not abolish the market place as the determiner of values and rewards, it rigged the market plenty."

The Supreme Court voided NRA *not* because the act abandoned competition but because it constituted an unlawful delegation of legislative power to the executive branch of the government.

We have been abandoning competition bit by bit in America for a long time. In two world wars and in the Korean War, our government fixed prices and allocated materials—an obvious necessity, an interference with the market place which even Adam Smith might approve. But he would not approve minimum wage and hour laws, farm price supports, tariffs, or subsidies—even health and safety laws for factories, or child labor laws, or laws establishing

minimum working conditions for women. In Smith's philosophy these would impede the market place in its benign work.

Adam Smith did not foresee powerful labor unions or social welfare or heavy technology. He marveled at the productivity attained by division of labor in the making of pins. He knew nothing about single electric-current circuit breakers big as a house. Although accumulation of capital from profit and its reinvestment in productive equipment were cornerstones of his philosophy, the scale of investment required for the subsequent technological advances was beyond his ken. Amusingly, he saw no future for the corporation, because, in his opinion, such an artificial body could not marshal the selfish, driving search for profit so fundamental to his system. Adam Smith taught Americans a faith in competition which persists despite heavy impingements by government, by big technology, and by social welfare upon the freewheeling, bazaarlike market place, in which Smith, two centuries past, saw competition as the benign hidden hand.

But the faith is compromised. On the domestic scene the federal antitrust laws are modified to forbid different prices among buyers of commodities of like grade and quality. Manufacturers of branded products are permitted, by amendment of the antitrust laws, to fix resale prices under state fair-trade laws. These and other amendments of the antitrust laws are said to establish "soft competition." The more rigorous antitrusters deplore these compromises, but Congress does not agree.

Antitrust doctrine forbids certain forms of "hard competition." For example, General Motors would hesitate to price its cars as low as its efficiency might permit, for fear of driving Chrysler, American Motors, even Ford to the wall. As critics put it, businessmen must compete, but no one may win the competition. It is this aspect of antitrust which creates two standards, one for big business, another for small business. No matter how vicious the competition of the little fellow, the big fellow must not countercompete too hard.

Abroad, cartels of all types have long been pillars of trade in Europe and in the British Isles. In the 1930s it was popular to attribute the declining state of European industry to cartelization. But now that vitality and prosperity prevail in all of western Europe, we must wonder whether the earlier analysis confused causation with concomitance.

In Communist Russia and China, competition is certainly not the way of economic life. State planning, bureaucratic decisions, the dictates of the commissars—these shape the pattern of economic activity. The decentralization and fragmentation of decision making, which we prize in our competitive economy, are to Russia and China just so much capitalistic foolishness.

Now, after almost half a century of Communism, we must concede its growth both in Russia and abroad. And as the first generation of Chinese Communism passes, we are baffled by its unexpected successes. The answer to the obvious question, Why did it take such a long time before we resorted to incarceration for failure to compete?, may lie here. Russian commissars have been liquidated, at the worst, or sent to Siberia, at the least, for deviation from Communist doctrine, or even for simply failing to achieve a planned production quota. The Communist system could not be wrong; only men could be wrong. And so in America we increased the severity of punishment for deviation from capitalistic doctrine, for failure to compete. We too must prove that the system cannot be wrong, only men can be wrong.

I do not like this explanation any more than I like our dancing to the Russian tune in foreign and military policy. But a lethal force is loose in the world, and America is frequently on the defensive. Robert A. Bicks, a brilliant young New York attorney who was nominated by President Eisenhower to be in charge of the Antitrust Division, put our American embarrassment quite simply: "These men and companies have in a true sense mocked the image of that economic system which we profess to the world."

But one of the eight conspiracies was a quarter of a century old, according to *Fortune* magazine (April, May, 1961); others had endured for more than a decade. One suspects that the Russians caught their doctrinal deviates much more quickly. Does this mean that for all of our protests in and out of government we are less sure of our doctrine than we admit? Even Teddy Roosevelt was charged with an ambivalent attitude towards trusts.

Profit Is a Part of Free Enterprise

There are two parts to free enterprise: one is competition; the other is profit. Men compete because there are profits. This is straight out of Adam Smith. The profit part of the system has never been repealed. The system does not work on losses. That way has been tried, and the records of the bankruptcy courts attest the unsatisfactory results of that deviation. Therefore, however enlightened a corporate head may be, however socially conscious his pronouncements, whatsoever the corporate charities, profit is the *sine qua non*. A top executive may say that there is more to modern business than profit making, but before the applause has died away he will have some vice president, division head, or department manager on the carpet for unsatisfactory profits. This does not mean that the talk is double. It simply means that without the profit the stuff for humanitarianism is not there.

When competition does not yield profits, as it often does not, in the eyes of the businessman one half of the system fails. It is then that the front-line soldiers of the system feel a desperate need to alter conditions. Price wars are deadly to the system, even though price fixing may be anathema to consumers. Herein lies a conflict, inexorable and as yet unresolved in our society. I have spent 40 years advising clients to respect and obey the antitrust

laws. But I would be far less than honest if I did not concede that the conflict is there.

To the businessman, a social philosophy constructed in an economy in which pin making was a marvel (1776) is not necessarily adequate for an economy of electric generators and nuclear reactors. To those who labor in the system, a philosophy which makes the good society depend upon blind competition carried on in ignorance of market facts and in disregard of the profit which, and which alone, can give the business institution permanence —such a philosophy seems irresponsible. Such men find themselves pressed on the one hand by the dogma, Compete yourself out of profits. On the other hand, they are pressed to conserve the business, to make it grow, to keep it ready for every change, from peace to war, from old styles to new styles, from obsolete technology to advanced technology. The businessman does not understand why his quest for certainty is wrong, why the dogma of competition should be pressed so far as to make a guessing game of the system.

I do not extol business or businessmen. That is not my purpose. I point rather to a failure of our business actors to understand our business theorists, a failure of such major proportions that we must examine the theory. It is not enough just to condemn and punish.

Our System Must Be Examined

We have never faced up to a frank and exhaustive examination of our system. In 1953, Attorney General Herbert Brownell Jr, appointed a distinguished committee of antitrust lawyers, law teachers, economists, and government officials to make "a thoughtful and comprehensive study of our antitrust laws." There was not one practicing businessman on the committee of 60. The committee produced a scholarly compendium of comment on the antitrust laws but made no significant recommendations. The report makes no reference to the problem of profits vs competition.

The economist may regard profit as only a transitory agent for producing equilibrium. In his book, profit serves not as a reward but as an inducement to competitors to enter the market and take the profit away, from enterpriser after enterpriser. But to the businessman, this is just so much academic nonsense. To him, the profit is the reward for good management, and the loss is the unpardonable business sin.

Practicing antitrust lawyers and government antitrust lawyers are a kind of priesthood spinning ever more gossamer refinements of the antitrust commandments. Businessmen are excluded from the councils in the legal temple. Between the government and businessmen there is a cops-and-robbers atmosphere. This is bad. It is doubtful whether America can long afford such immature attitudes. When Roosevelt moved in the courts against Northern Securities Co, Morgan asked why the President could not have come to him as one gentleman to another and made known the government's wishes. I think Morgan had a point. For some reason, gentlemanly relations were never established. Businessmen move at their peril while the law waits in ambush.

In the electrical cases the record shows that the guilty individuals and companies alternated between fierce, quarterless competition and unabashed price fixing. There were times when the price cutting reached as high as 60% of the going price. Suppose a study were made to determine the reasonableness of the *average* prices over the whole period in which the conspiracies were on and off. The antitrust doctrine is that reasonableness does not matter. Very well. But are we afraid even to look? Are we, like medieval doctors, unwilling to test the dogma; like them, unwilling for Galileo to drop the balls?

Suppose Congress should provide an amnesty, forgiving all companies and individuals who would make full disclosures of past infractions of antitrust law. The investigators, turned scientists from prosecutors, would develop a kind of economic *Kinsey Report*. Then economists, psychologists, sociologists, and people from other relevant professions, having access to all the facts, might evaluate the doctrine and measure the harm, if any, which has ensued from the deviations.

When police methods fail, for example, in curbing juvenile delinquency, we apply investigatory and analytical techniques. Often the detection of the causes of antisocial activity results in social change. If doctrine and dogma on the one hand and business and businessmen on the other will submit to exhaustive fact finding and an uninhibited critique, we may discover the common ground for competition and profit, the way to a more stable economy, and an end to internecine distrust. Our hard-pressed country can no longer afford sadism in government and paranoia in business.

A less ambitious program, but one quite worth while, would be an amendment of the Sherman Act which would require the government to employ the noncriminal remedies of the act before invoking the criminal penalties. In the civil proceedings, the courts' equity powers to order cessation of practices and to require new practices are almost without limit. After having heard a given case, the court might then decide whether civil remedies were enough or whether to authorize the Attorney General to proceed for recriminatory criminal penalties. Such an amendment would take some of the gaming out of antitrust enforcement. It would give a partial answer to Mr. Morgan's reasonable question, Why couldn't the government make known its wishes rather than suing as if he were a "common crook"?

There are those who will say that the men of the electrical conspiracy *are* common crooks. But the case is not that simple. It is necessary to differentiate. The men whose jail terms must make us *think* are more like those who violated Prohibition than those who burgle a house. A society which has not resolved the periodic incompatibility between competition and profits, has not cured its business cycles, is not able to explain fully its economics—such a society does not have the right to cast first stones at those who must work its imperfect system. The men were guilty, but guilty in a system which is itself not without blame.

Why USS "T-1" Steel spiral cases were used on 5 famous power projects
Oahe □ Niagara □ Noxon Rapids □ Brownlee □ Swift

Oahe Dam will be the world's largest rolled earth dam . . . 9,300 feet long and 242 feet high. It will make a lake 250 miles long on the Missouri River above Pierre, South Dakota. Seven hydro-generators will have a total installed power capacity of 595,000 KVA.

USS "T-1" Steel cuts weight of spiral cases. Water for power generation will flow through seven spiral cases with inlet diameters of 20½ feet. USS "T-1" Constructional Alloy Steel not only met all requirements, but permitted a reduction in steel weight of about 45%. Total amount of USS "T-1" Steel used was 1,002 tons.

Continued on next two pages

This mark tells you a product is made of modern, dependable Steel.

United States Steel USS

TRADEMARK

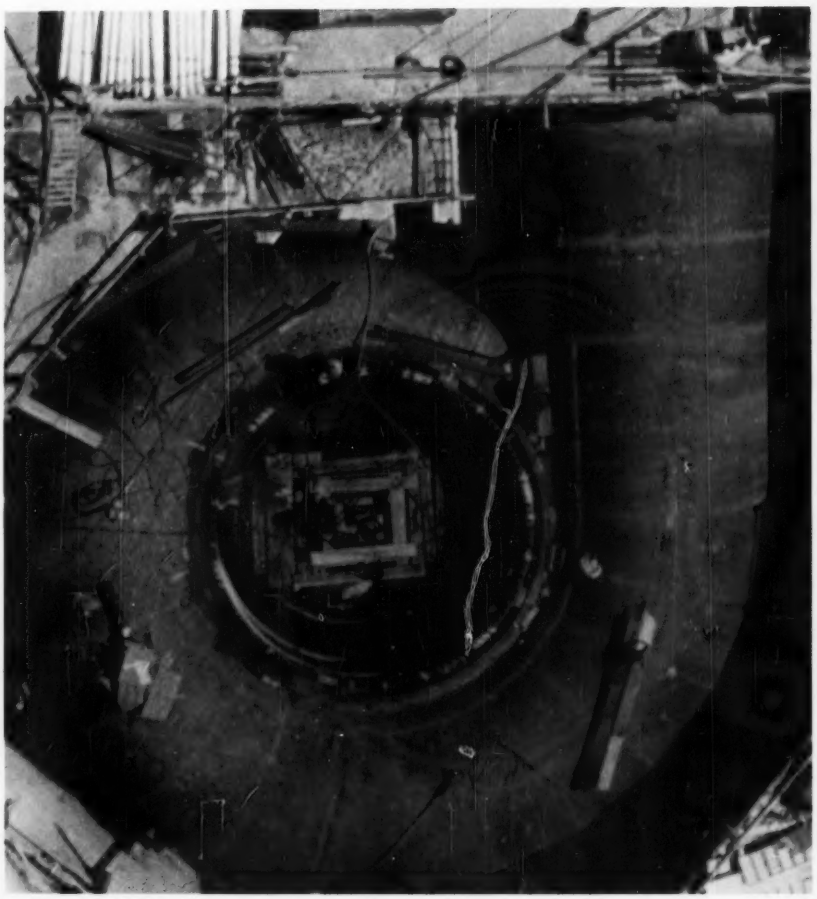
USS "T-1" Steel cuts

Continued from page one

Cost savings. By using USS "T-1" Steel with a minimum yield strength of 100,000 psi, plate thicknesses ranged from ½" to 1¼". With carbon steel, the spiral cases would have been almost twice as thick. Result: large savings in freight costs, erection time, and field welding costs. In future projects, costs might be reduced even more by the use of our new, more economical USS "T-1" type A Steel, which has the same strength.

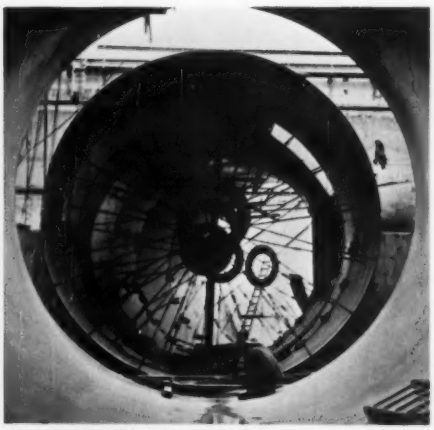
Carbon steel liners 24 feet in diameter for the seven hydroelectric power tunnels were fabricated by U. S. Steel's Consolidated Western Steel Division using 20,000 tons of structural carbon steel to make 449, 30-foot-long sections.

The Oahe Dam is being constructed under the supervision of the Corps of Engineers—U. S. Army, Office of District Engineer, Omaha, Nebraska. Powerhouse A-E: Sverdrup & Parcel & Associates, Inc. Powerhouse Contractor: Atkinson-Ostrander Company. Spiral cases were fabricated by the Hydraulic Division of the Allis-Chalmers Manufacturing Company (the supplier of completed turbines), and field welded and assembled by Chicago Bridge & Iron Company. Generators were supplied by General Electric Company.

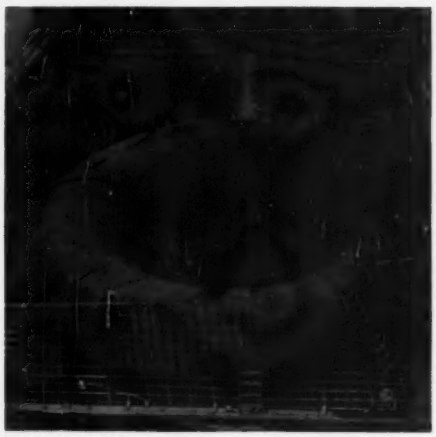


Niagara Power Project, Robert Moses Niagara Power Plant, The Power Authority of the State of New York. One of the largest power projects of all time. Total capacity—2,471,000 KVA. Thirteen spiral cases in main power plant designed for a 314-foot head of water, with inlet diameters of 21 feet, required 1,300 tons of USS "T-1" Steel. A design stress of 23,000 psi was used with a 100% joint efficiency for welds—all welds were X-rayed. Shell plates ranged in thickness from 0.36 to 0.97 inches and wing plates from 15/16 to 1⅞ inches. Hydraulic turbine builders: Baldwin-Lima-Hamilton Corporation and Newport News Shipbuilding & Dry Dock Company. Fabricators of the 13 spiral cases: Chicago Bridge & Iron Company–7 cases (plus field erection of all units), and Newport News Shipbuilding & Dry Dock Company–6 cases. Engineers: Uhl, Hall and Rich; general contractor: Merritt-Chapman & Scott Corporation.

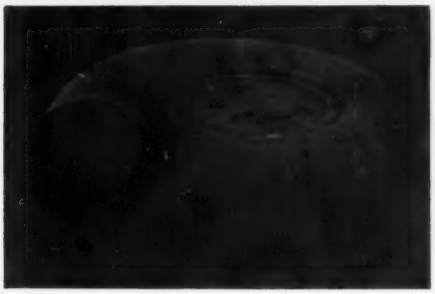
weight of spiral cases up to 50%



Noxon Rapids Dam



Brownlee Dam



Swift Creek, Plant No. 1

Noxon Rapids Hydroelectric Project, Clark Fork River, Montana, The Washington Water Power Company of Spokane, Washington. Project's power capability—400,000 KW. The four spiral cases have inlet diameters of 24 feet, some of the largest ever built of field-welded USS "T-1" Steel. The spirals were designed for a 154-foot head. A design stress of 27,500 psi was used with a joint efficiency of 90% and all welds were X-rayed. Plate thicknesses were reduced approximately 50% from those that would have been required in carbon steel. The field erector, Chicago Bridge & Iron Company, used 432 tons of USS "T-1" Steel. Turbines by Allis-Chalmers Manufacturing Company; generators by General Electric Company; consulting engineers: Ebasco Services, Inc.; general contractor: Morrison-Knudsen Company, Inc.

Brownlee Dam, Snake River, Idaho, Idaho Power Company. Project's power capacity—450,000 KVA. Four initial spiral cases with inlet diameter of 18 feet were fabricated from 368 tons of "T-1" Steel. The cases were designed for a pressure of 148 psi. A design stress of 26,250 psi was used with a joint efficiency of 80% (21,000 psi). Plate thicknesses ranged from 13/16" maximum to ½" minimum with a weight saving of 45%. Fabrication was by Hydraulics Division of Allis-Chalmers Manufacturing Company. Engineering by International Engineering Co., Inc.; general contractor: Morrison-Knudsen Co., Inc.

Swift Hydro Project, Lewis River, Washington. Pacific Power & Light Company. Plant's power capacity—225,000 KVA. 126 tons of "T-1" Steel were used by the Hydraulic Division of Allis-Chalmers Manufacturing Company to fabricate three spiral cases with 11-foot inlet diameters and a design pressure of 205 psi. Plate thicknesses ran from 13/16" to 15/16" with an approximate saving in weight of 45%. Engineering and management by Bechtel Corporation; powerhouse construction by Guy F. Atkinson Company; other construction: Chas. H. Tompkins Company (now owned by J. A. Jones Construction Company). Generators were supplied by General Electric Company.

5 Projects—31 "T-1" Steel spiral cases. The trend today is toward large-diameter, field-welded spiral cases subjected to relatively high pressures. Under the ASME Code case 1204-8 for boilers and pressure vessels, the allowable stress value is 28,750 psi for USS "T-1" Steel compared to 13,750 for A285C Steel. Save up to 50% in the weight of steel, up to 50% in freight, about 30% in field fabrication cost, 60% in the weight of welding wire required . . . and the total cost of the steel is only slightly more. Write to United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania, for complete information on USS "T-1" Steel. USS and "T-1" are registered trademarks.

United States Steel Corporation • Columbia-Geneva Steel Division
Tennessee Coal and Iron Division • United States Steel Supply Division
United States Steel Export Company

USS United States Steel

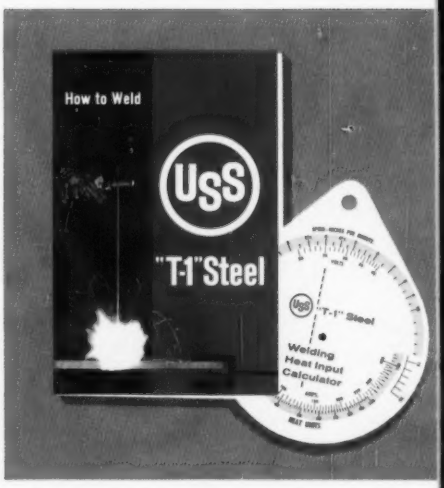
Send for new movie, "How to Weld USS 'T-1' Steels"

This new 18-minute, 16mm color motion picture shows concisely the practices involved in welding USS "T-1" Steels. If you are fabricating "T-1" Steel in your shop, this film and copies of the booklet will be a big help in demonstrating the proper technique to your welders. Fill out the coupon below and indicate the number of booklets you will need.

Included in the booklet is a handy welding heat-input calculator that helps a welder choose the proper welding machine settings. The film, together with the booklet, will help every welder to weld USS "T-1" Steels readily and successfully.

We'll gladly lend you the film and furnish enough free copies of the booklet and heat-input calculator for your shop personnel. USS and "T-1" are registered trademarks.

United States Steel Corporation • Columbia-Geneva Steel Division
National Tube Division • Tennessee Coal and Iron Division • United States Steel Supply Division • United States Steel Export Company



United States Steel

USS

United States Steel, Room 6411
525 William Penn Place
Pittsburgh 30, Pennsylvania

Gentlemen:

Please lend me your 16mm color, sound movie, "How to Weld USS 'T-1' Steels." Also, send me_____booklets of the same title. I understand there is no obligation.

Name_____

Title_____

Company_____

Address_____

City_____ **Zone**_____ **State**_____

1962 LBE Plans Give Big Impetus to Heating

The heart of the Total Electric Home and of the Live Better Electrically Program is electric heating.

This was the word at the kick-off of the 1962 LBE program at a press conference November 30 in New York.

Albert V. Lowe, LBE program manager, presented details of the 1962 program, which included key advertising and promotion plans.

Going further into his statement about electric heating being the heart of the program, Lowe said, "We are proud to relate that over 1 million American homes are heated electrically today . . . A giant step in the direction of the 5.2 million homes that will be electrically heated by 1970, and this figure is conservative."

Lowe pointed out that a recent nation-wide survey showed that 86% of homeowners interviewed are not only aware of electric heat, but eight out of ten say that electric heat is clean. "And cleanliness is the feature that our advertising has been featuring consistently and dramatically" he said.

An all-out promotion of electric heating by LBE will be 22 full-page heating ads in the *Saturday Evening Post, Life, Better Homes & Gardens,* and *American Home*. This is the beginning of a long-range program that, with the help of local utility promotions, will "far surpass that conservative 5.2 million forecast," Lowe said.

The launching pad for this campaign will be an eight-page, full-color insert in the February issue of *Reader's Digest,* featuring flameless electric heating and air conditioning.

Member utilities, manufacturers, and trade associations have ordered 1.2 million reprints, 3,080 dispenser boxes, and 2,570 banners.

The home builder is recognized as a "fundamentally important influence in our promotion of the total-electric concept," according to Lowe. "We have on hand a list of almost 6,000 significant builders who have recognized the tremendous competitive advantage of offering to their prospects the unequaled modern benefits of Living Better Electrically in a Total Electric Gold Medallion Home," Lowe said. "And the proof of this pudding is in their sales results, of which we have miles of taped interviews."

Builder testimonials are the nucleus of the builder advertising program represented by 14 black-and-white spreads scheduled for *House & Home* and the *NAHB Journal of Homebuilding* in 1962.

Four-color appliance ads, a series of 12, will appear in *Life, Saturday Evening Post, Better Homes & Gardens,* and *American Home*. These ads will feature ranges, water heaters, and dryers.

"Here competitively we are making significant progress," Lowe said. (See box).

"Realistically, we can forecast a major breakthrough in the range area in 1962. Electric range sales will overtake and surpass gas range sales of all types."

Even closer to LBE hearts is the Gold Medallion Home Program. This series of ads will feature the Total Electric Homes of families in all sections of the country, plus heating, appliances, lighting, and Housepower. Thirteen GMH ads will run in the same magazines as ranges, water heaters and dryers.

It is the utility tie-in advertising that makes the LBE Program complete. "We at Live Better Electrically, through our national efforts, build a bridge half-way across the river. In recognition of this fact, electric utilities will continue to run ads of their own that tie in with the major ideas and main themes of the national LBE Program," Lowe commented.

This will be supplemented by supporting advertising of manufacturers of electrical equipment.

The total program will spend $52.5 million, $2.5 million by LBE, and $50 million from manufacturers and utilities.

Going back to the electric heating potential, Lowe pointed out that there are 52 million homes in the US, and every one has used or will use electricity to some degree.

With one out of 50 homes having electric heating, it leaves 51 million without electric heating. Ten million homes have air conditioning, leaving 42 millon prospects, accordng to Lowe. "Here is the big, big market for the future—Complete Electric Climate Conditioning."

He emphasized the potential of the market by stating that 1961 sales of electric heating equipment will total 5.5 million kw, and between 1961 and 1970 the potential is 20.4 million kw.

Also air conditioning sales this year should be 1,720,000 units, with a potential by 1970 of more than 20 million units.

Lowe also emphasized that the key word in LBE will still be "flameless." "We will sell (it) more forcefully than before in every thing that we do in 1962," he said.

(*More Selling on page* 106)

Competitive Statistics
(Sales)

	Electric Range	Gas Range
1960*	1,162,100	1,383,100
1961*	1,172,500	1,338,900
	Electric Water Heater	**Gas Water Heater**
1960*	553,000	2,116,400
1961*	571,000	1,919,300
	Electric Dryer	**Gas Dryer**
1960**	632,779	344,946
1961**	600,348	318,771

* First 9 months
** First 10 months

How electric utility rates are established—

This book fully covers basic electric utility economics: regulation, competition, earnings, revenues and expenses, public and employee relations, etc. Appropriate charts, diagrams and tables help provide detailed analysis of the price structure and its end result, the tariff, or practical means of charging for service. The principal rate classes, forms, and schedule provisions in use today are described and there are worked-out examples of bill calculations and fuel cost adjustment.

ELECTRIC UTILITY RATE ECONOMICS
By Russell E. Caywood
Manager of Rates, West Penn Power Company
236 pages, 6 x 9, 60 charts and tables, $10.00

"A worthy addition to the literature of electrical utility rates . . . a practical book which should appeal to the practical man."
Public Utilities Fortnightly

SEE THIS BOOK 10 DAYS FREE

McGraw-Hill Book Co., Dept. FW 12-11
330 W. 42nd St., NYC 36

Send me a copy of Caywood's ELECTRIC UTILITY RATE ECONOMICS for ten days' examination on approval. In 10 days I will remit $10.00, plus a few cents for delivery, or return the book postpaid. (We pay for delivery if you remit with this coupon; same return privilege.)

(Print)
Name .....
Address .....
City ..... Zone.... State .....
Company .....
Position .....FW 12-11

For price and terms outside U.S. write McGraw-Hill Int'l., NYC 36

NATION'S LARGEST FEDERAL SAVINGS ASSOCIATION

pays you 4½% on savings

DIVIDENDS PAID QUARTERLY at 4½% current annual rate • World-wide savings service for 180,000 individuals, corporations and trusts in 50 states, 76 foreign countries • Same, sound management policies since 1925. Assets over $690 million • Accounts insured by Federal Savings & Loan Insurance Corp. • A man and wife, with 2 individual accounts and 1 joint account, can have up to $30,000 in fully insured savings • Funds received by 10th, earn from 1st. • We pay air mail both ways • Mail check or money order with coupon below.

CALIFORNIA FEDERAL SAVINGS
and Loan Association · Head Office: 611 Wilshire, L.A. 17

FREE FINANCIAL GUIDE: "The California Story" contains experts' ideas on saving money, investing in homes, insurance, stocks. Other exciting features!

California Federal Savings & Loan Assn. E-2
Box 54087, Terminal Annex, Los Angeles 54, Calif.

Please send free "The California Story" and Cal Fed MAIL-SAVER® to:

Name _____
Address _____
City _____ Zone ____ State _____
☐ Funds enclosed in amount of $ _____

Selling (*Continued from page* 105)

SEE Publishes Competitive Manual

An all-out battle against competition, "whether it be competition from gas, other fossil fuels, public power, or socialism of the industry" has been launched by the Southeastern Electric Exchange with the publication of its Competitive Reference Manual.

The objective of the manual is to bring together all of the data, materials, and ideas to enable electric utilities to meet and beat the competition.

The manual is also described as "a reference manual of reliable information presented in easy-to-read, illustrated form, sorting out and separating fact from conjecture, so that electric utility representatives can build sales arguments on sound foundations."

The manual contains five separate sections dealing with individual competitive applications: Dryers, resistance heating, post lights, ranges, and water heaters. Each section is printed in two colors in looseleaf form so that it can be used alone or in combination with other sections. A looseleaf binder is available to contain the complete set of five sections with indexed dividers.

The manual is being made available first to member companies of the SEE but later will be distributed to electric utilities and industry allies in other sections of the country.

Prices are:

Member companies: $3.00 per set of five sections, or 75¢ for each section; looseleaf binder, $2.00 plus shipping. Non-member companies: $5.00 per set of five sections or $1.00 for each section; looseleaf binder, $2.00.

Orders or inquiries should be sent to: Southeastern Electric Exchange, 711 Haas-Howell Building, Atlanta 3, Ga.

The outstanding feature of the manual is the portion in each section devoted to differences between the electric appliance and the gas appliance.

William B. Shenk, Florida Power Corp vice president, and chairman of the SEE Competitive Committee pointed out at the SEE General Sales Conference in St. Petersburg, last month, that the manual is the outgrowth of the formation in 1959 of the Competitive Committee because of a "recognized need for factual up-to-date competitive information to be used by SEE member companies in meeting the ever-increasing competition of natural gas and other competition."

Shenk pointed out this was necessary because, "in almost every instance where electric equipment in the past had a distinct advantage, the gas people had come up with their own answer that nullified that advantage. What is more, the gas industry information read like pages from our own books, utilizing all of our time-honored statements of advantages of electric over gas, but substituting gas for electric and vice versa."

E-Z RED

Non-interchangeable
BREAKERS
Easy TO INSTALL AND INSPECT

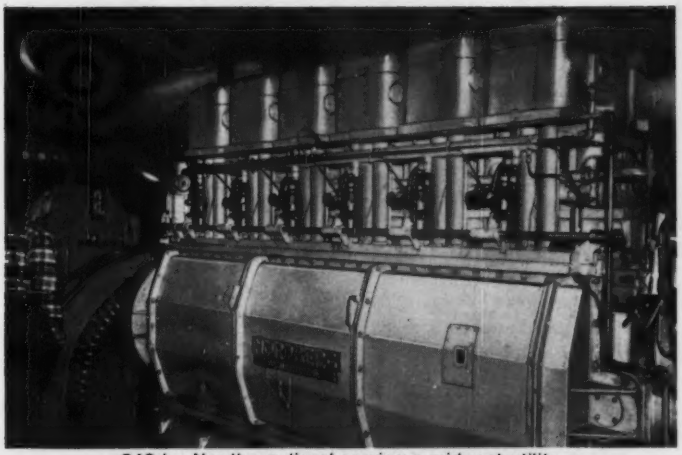
FOR SINGLE POLE— TIGHTEN only ONE SCREW
FOR DOUBLE POLE—TIGHTEN only TWO SCREWS
A regular screwdriver is all you need — No special tools

KEEP PACE WITH ELECTRICITY

PLEASE WRITE TO DEPT. 203B FOR COMPLETE INFORMATION

The WADSWORTH Electric MFG CO INC. COVINGTON KENTUCKY

Cut power costs with NORDBERG ENGINES



840 kw Nordberg diesel serving a midwest utility.

Two 2500 kw Nordberg diesels serving an eastern utility.

2285 kw Nordberg diesel, one of three in a southern utility.

FOR STANDBY SERVICE

If lack of sufficient power makes it difficult to hold generating costs "down," and standby reserve "up," it will pay you to investigate the advantages of Nordberg engines. These efficient prime movers are easily installed independent of existing power facilities, go on the line quickly, and generate low cost power under all load conditions.

FOR PEAK LOAD SERVICE

If your base generating station is having difficulty "topping the load" at an economical figure, follow the example of many utilities who have assigned peaking problems to Nordberg engines . . . and in doing so have also added desirable generating flexibility and standby protection while amortizing their investment through more profitable operation.

FOR BOOSTING VOLTAGE

If your load has grown beyond the capacity of the existing transmission system and if there is difficulty maintaining voltage in outlying areas, Nordberg engines can give you the increased capacity at low cost per kw. These efficient units are easily installed, and can be readily tied into the line at strategic locations to boost the voltage.

We will welcome your inquiry and the opportunity to discuss the advantages of Nordberg engines for your specific power requirements. Write for further details.

©1961, N. M. CO. P859-R

NORDBERG MANUFACTURING COMPANY • Milwaukee 1, Wisconsin

ATLANTA • CLEVELAND • DALLAS • DULUTH • HOUSTON • KANSAS CITY • MINNEAPOLIS • NEW ORLEANS
NEW YORK • PHOENIX • ST. LOUIS • SAN FRANCISCO • TAMPA • WASHINGTON • WICHITA, KAN.
TORONTO • VANCOUVER • JOHANNESBURG • LONDON • MEXICO, D. F.

News About People

Iowa-Illinois G&E Names New Vice Presidents

Iowa-Illinois Gas & Electric Co has named J. H. Bartley vice president-administration, and E. T. Williamson, senior vice president.

Previously Bartley served as controller and Williamson as vice president and chief of staff.

Bartley began his utility career in 1924 with Peoples Power Co, a predecessor of Iowa-Illinois G&E. He was named assistant controller in 1954 and controller in 1956.

Williamson has been with Iowa-Illinois and predecessor companies since 1924 serving as engineer, district manager, assistant to the president and vice president in charge of operation.

BARTLEY WILLIAMSON

WHITE ▶

White Becomes BPA Chief Engineer

Eugene L. White has been appointed chief engineer of the Bonneville Power Administration.

White joined BPA in 1938 as a project engineer. From 1942 to 1954 he was assistant to the chief engineer.

Before joining the government, White spent 12 years as transmission and distribution engineer with the Puget Sound Power & Light Co, and nearly two years as a test engineer with the General Electric Co.

PERSONAL BRIEFS

Harold A. Howard has been elected secretary and treasurer of New York State Electric & Gas Corp, succeeding **T. Fred Rowe,** who retired.

Central Illinois Public Service Co has appointed **H. E. Ury** to the newly created post of public affairs representative for eastern division operations. **Robert G. Lane** succeeded Ury as the division's commercial supervisor.

Thomas J. Kozak has been promoted to rate division director at Toledo Edison Co. He succeeded **William E. Trimble,** who retired.

At West Penn Power Co, **Robert B. Van Atta** has become publicity supervisor and **John K. Walter,** manager of public relations, both within the newly formed public relations department.

Kenneth A. Johnson has been promoted to rate engineer at Minnesota Power & Light Co.

New assistant treasurer at Duke Power Co is **Richard B. Henney.**

Albert W. Huseby has been named administrative assistant to the executive vice president in charge of engineering and construction for American Electric Power Service Corp.

Pacific Gas & Electric Co has appointed **Frank G. Rothganger** as manager of commercial, industrial and agricultural sales, **William O. Cheney** as chief of the engineering research department, heading the Emeryville laboratory, and **Gordon V. Richards** as supervising civil engineer at the lab.

James R. Birrell has been named director of purchasing and traffic by Public Service Co of Colorado. He replaces the late **Roy T. Blanchard.**

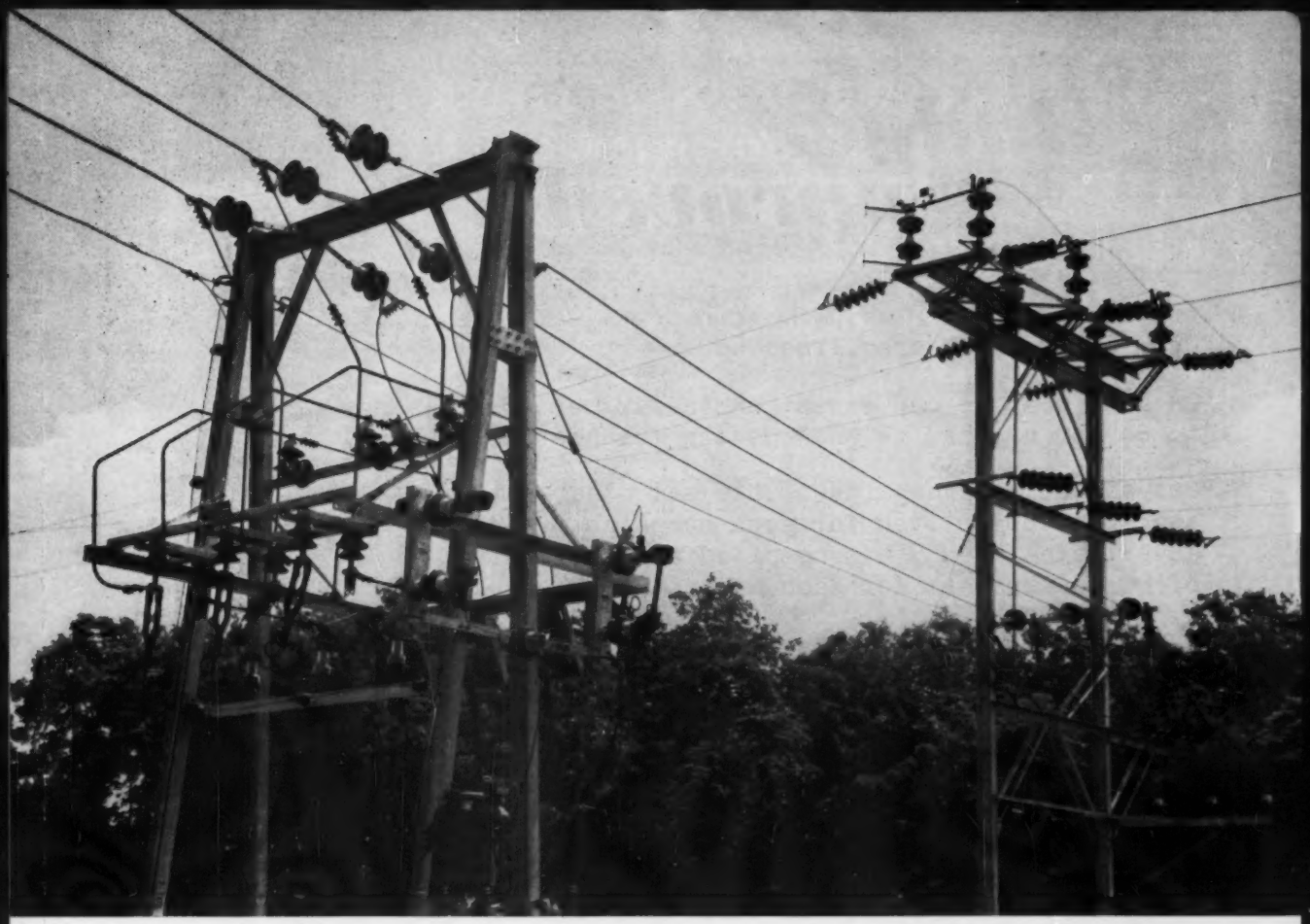
Niagara Mohawk Power Corp appointed **Richard H. Kukuk** as Albany district manager, **George L. Johnson** as Albany-Troy area manager, and **Charles M. Hill** as Troy district manager.

William G. Chaney has been appointed manager of mobile telephone systems engineering and personal communications engineering for General Electric Co's communication products department, Lynchburg, Va. **Donald R. Hughes** is the new manager of the portable appliance department plant.

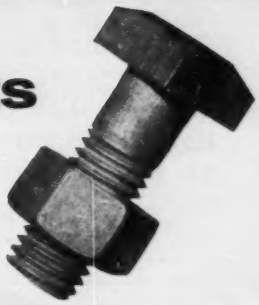
P. R. Mallory & Co, Inc, has boosted **Robert A. Currie** to public relations director.

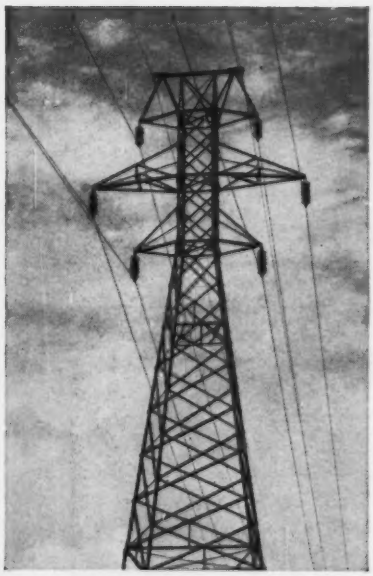
John Caldwell has joined Southern States, Inc, as assistant engineering manager-development.

Colorado Fuel & Iron Corp has elected **Leonard C. Rose** as president, succeeding **Alwin F. Franz** who became chairman of the board. **Charles Allen Jr,** chairman since 1945, will continue in close association with the company.



Bethalume Tower Bolts





STEEL FOR FULL STRENGTH . . .
BETHALUME-COATED
FOR MAXIMUM PROTECTION

For transmission towers and substation structures, Bethlehem's Bethalume tower bolts give maximum protection against corrosion . . . especially in highly contaminated industrial atmospheres. For the first time, this protection will last as long as that of the tower members. And, you get the corrosion-resistance of aluminum combined with the unbeatable strength of steel.

Coated by a hot-dip process, Bethalume bolts are compatible with both galvanized and aluminum structural members. In addition, Bethalume tower bolts are non-galling.

Let us give you the facts which back up these statements. Test results are now available. For more information call the nearest Bethlehem office. Or write to us in Bethlehem, Pa.

Steel *for Strength*
. . . Economy
. . . Versatility

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Budget Approved!

"Our '62 ad plans are firmed up.

"We know what we can expect businesspaper advertising to do for us, and we know how to measure the results.

"Our advertising department has set clear-cut and sound objectives for each campaign...and our advertising agency has compiled a tight list of businesspapers for each market.

"Our ads will be good ads, written and designed by top agency talent. We insist on this.

"Our marketing executives have been in on the planning from the start and our in-print selling will be closely coordinated with our personal selling.

"We don't know if the GNP will go up 2%, or down 5% in 1962. We don't know what will happen in Berlin, Laos, Africa or Cuba.

"We do know that our company is going all out to increase its sales, its share of market, its profits. And because we also know just how business advertising can contribute to these management objectives, our budget is approved and the '62 program is in production.

"How are you doing?"

ASSOCIATED BUSINESS PUBLICATIONS
205 East 42nd St., New York 17, N. Y.

CLASSIFIED SEARCHLIGHT SECTION ADVERTISING

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

LARGE POWER EQUIPMENT
Prompt Stock Shipment
RENUBILT MOTORS - GENERATORS
TRANSFORMERS - CIRCUIT BREAKERS
DO YOU GET OUR STOCK LIST?
BELYEA COMPANY, INC.
51 Howell St. Jersey City, N. J.
OL-3-3334

Looking for Representatives to SELL Electrical Equipment

Write for copy of EERA Directory

CY SWARD, Exec. Dir. EERA
1675 Fifth Street, Clermont, Florida

ADDRESS BOX NO. REPLIES TO: Box No. Classified Adv. Div. of this publication. Send to office nearest you.
NEW YORK 36: P. O. Box 12
CHICAGO 11: 645 N. Michigan Ave.
SAN FRANCISCO 11: 255 California St.

POSITION VACANT

Electrical Engineer, Graduate E.E. to take charge of relay, meter substation maintenance and line department for progressive 150 MW system. Location south central U.S. Ideal opportunity for ambitious man. Send resume and salary expected. P-7925, Electrical World.

U. S. Government

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-5714) will be received at Denver, Colorado, until 2 p.m., Mountain Standard Time, January 9, 1962, for furnishing four 138-kv, 5,000,000-kva, 1,200 ampere, airblast, gas-filled or oil type power circuit breakers for Flaming Gorge Switchyard, Colorado River Storage Project, Utah-Wyoming. Delivery is desired within 270 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver 25, Colorado. Floyd E. Dominy, Commissioner.

TURBINE GENERATORS

1—**3000 KW, 2 phase, 2300 volt generator with 185# P.S.I. turbine (Both Westinghouse),** complete with Alberger surface condenser and associated equipment.

1—**2000 KW, 2 phase, 2300 volt generator (Elliot) with 185# P.S.I. turbine (Kerr),** complete with Schutte and Koerting multijet condenser and associated equipment.

Any reasonable offer considered. Address replies to **Mr. W. S. Oxley, The Patchogue Electric Light Company, Postoffice Box 510, Patchogue, New York.**

MOVING? SEND FOR BOOKLET

A free, 16-page booklet prepared by Burnham Van Service, Inc., can give you helpful, work-saving, cost-saving pointers on hw to organize your move from city to city when you change jobs. How to prepare to move, tips on packing, a helpful inventory checklist of things to do are among the topics included. Write for your free copy. No obligation. Miss Mary Ellen Flynn, Burnham Van Service. 1634 Second Avenue, Columbus, Georgia

SWITCHGEAR MARKETING

Growth opportunity for graduate engineer with 4–7 years experience in metal-clad or related switchgear application and sales. Send complete resume including salary requirement to:

Moloney Electric Company
Switchgear Division
Attn: Sales Manager
4330 Geraldine Avenue
St. Louis 15, Missouri

SALES ENGINEER

Home office of Diesel Engine Division offers an excellent opportunity for a graduate engineer with selling or sales office experience.

Basic assignments after training include estimating and preparing bids and proposals, follow-up work on new orders, handling general sales correspondence and liaison with vendors and visiting customers.

Position has definite advancement potential leading to direct sales assignment in one of our District Sales Offices.

Submit detailed resume and salary requirement to:

Employment Manager
NORDBERG MANUFACTURING COMPANY
Milwaukee 1, Wisconsin

PROFESSIONAL SERVICES

INTERNUCLEAR COMPANY
Nuclear consultants, engineers, and designers
Economics of Nuclear Power, Reactor Analysis and Design, Shielding, Special Applications
Subsidiary of Petrolite Corporation
7 N. Brentwood Blvd., Clayton 5, Mo.

PIONEER SERVICE & ENGINEERING CO.
Consulting & Design Engineers
Public Utilities—Industrials
Purchasing—Construction Management
231 So. La Salle St. Chicago 4

BLACK & VEATCH
Consulting Engineers
Electricity—Water—Sewage—Industry
Reports, Design, Supervision of Construction
Investigations, Valuations and Rates
1500 Meadow Lake Parkway
Kansas City 14, Missouri

MINER AND MINER
Consulting Engineers
INCORPORATED
GREELEY, COLORADO
Littleton, Colorado
Tucson, Arizona Phoenix, Arizona

SANBORN MAP COMPANY, INC.
Nation Wide Mapping Services
• Utility Area Base Maps
• Symbolized System Portrayal
Atlanta - New York - Chicago - San Francisco

THEODORE D. BROSS LINE CONSTRUCTION CORP.
Steel Tower & Wood Transmission Lines
Distribution & Maintenance
175 Enfield St. Hartford, Conn.

MULTI-AMP DIVISION
MULTI-AMP ELECTRONIC CORPORATION
Designers • Engineers • Builders
Portable electric test equipment
Field and laboratory instruments; load boxes.
For low voltage testing and calibrating of circuit breakers, protective and overload relays, reclosers, watt hour meters, fuse links.
63E Myrtle St. Cranford, N. J.

SARGENT & LUNDY
Engineers
Consultants to the Power Industry
STUDIES • DESIGN • SUPERVISION
140 South Dearborn Street, Chicago 3, Ill.

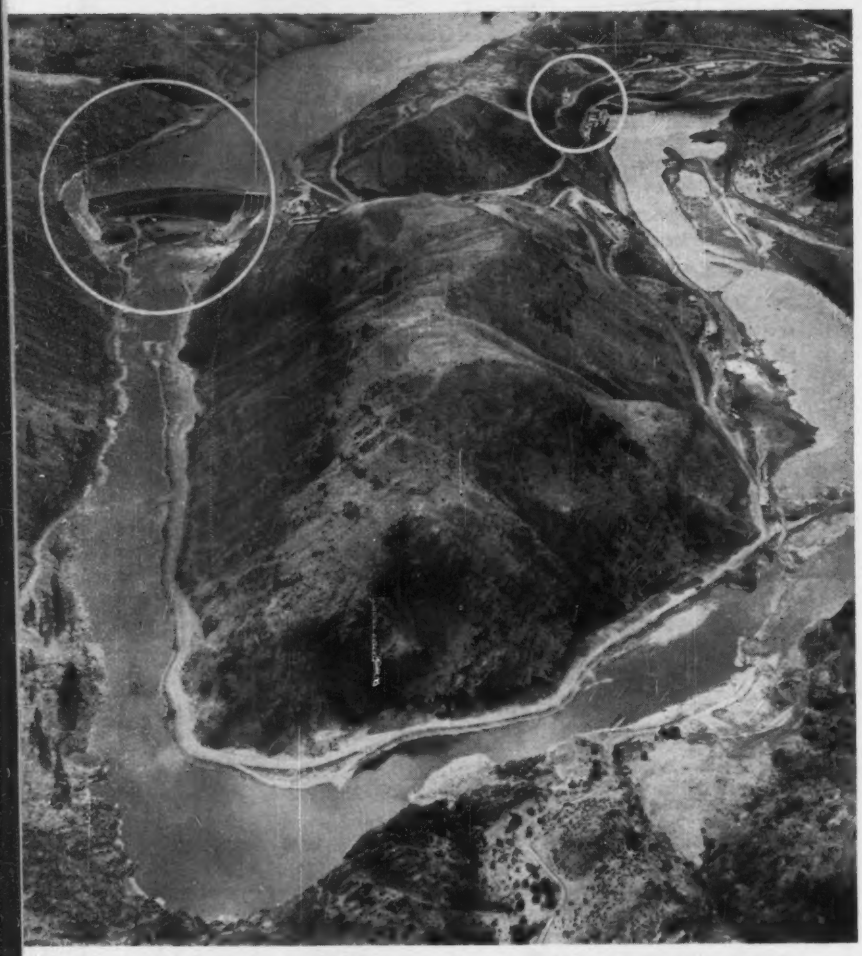
COMMONWEALTH SERVICES, INC.
Management and Business Consultants
500 Park Ave.
New York 22, N. Y.

ASSOCIATES, INC.
Consulting and Design Engineers
200 E. Washington
Jackson, Michigan

JENSEN, BOWEN & FARRELL
Engineers
Appraisals—Depreciation Studies—Property Records
Cost Trends—Special Studies—Reports for Rate Cases, Security Issues, Regulatory and Accounting Requirements
Michigan Theatre Building Ann Arbor, Michigan
NOrmandy 8-7778

TIPPETT & GEE
Consulting Engineers
Mechanical • Electrical • Thermodynamic
Structural Design • Studies • Supervision
Power Stations • Transmission • Distribution
Industrial Plants • Process
1323 North Second Street Abilene, Texas
214 Meadows Building Dallas, Texas

Idaho Power Co Puts Oxbow On The Line



IDAHO POWER CO'S OXBOW PROJECT harnesses a horseshoe bend in the Snake River. Water from reservoir behind the dam (left circle) flows through twin tunnels in the mountain to spin four generators in the powerhouse (right circle).

With the recent startup of its fourth generator, Idaho Power Co's Oxbow Dam (left) was completed.

Finish of the 220-Mw project marks the end of the second step in the company's plan for development of the Hells Canyon reach. The first step, 450-Mw Brownlee Dam, went on the line in January, 1959.

Idaho Power is already at work on the third of its dams to harness the Snake River. This is Hells Canyon Dam which will be built at a point where the gorge is more than a mile deep. When Hells Canyon is completed, output of the three projects will be more than 1,000 Mw.

Idaho Power President T. E. Roach commented at the dedication ceremonies that, "Completion of Brownlee and Oxbow, and the start of work on the Hells Canyon project are clear proof that Idaho Power is keeping faith with its promise to fully develop this 100-mile stretch of the Snake and provide dependable supplies of electricity as rapidly as possible . . . Thus far in our development," he pointed out, "we have invested millions of dollars in two great new sources of electricity, provided work for thousands of men, and generated additional taxes for local, state, and federal governments."

"Moreover," Roach added, "we have provided important public benefits of flood control, navigation and excellent recreational areas—all without cost to the taxpayer."

Advertising Index

Alcoa Aluminum Structural Div. 90, 91
Allis-Chalmers Mfg. Co. 45
American Electric Mfg. Co. 93
American Steel & Wire Div. United States Steel 42, 43
Anaconda Wire & Cable Co. 78, 79
Associated Business Publications 110
Atomics International Div. North American Aviation 95

Babcock & Wilcox Co. 6, 7
Bethlehem Steel Co. 109
Brown Boveri Corp. 18

California Federal Savings & Loan Ass'n. 106
Chance Co., A. B. 81
Chevrolet Div. General Motors Corp. 86
Combustion Engineering, Inc. 46, 47

DeLaval Steam Turbine Co. 84
Directory of Engineers 111
du Pont de Nemours & Co., (Inc.) E. I. Elastomer Chemicals Dept. 37
Polychemicals Dept. 82

Engineers, Directory of 111
English Electric Corp. 36

General Electric Co. ..32, 33, 73, 74, 75, 77
Gould-National Batteries, Inc. 89

Indiana Steel & Wire Co., Inc. 94

KPF Electric Co. 12, 13
Kerite Company 48

Lapp Insulator Co., Inc. 30, 31
Line Material Industries ...23, 24, 25, 26, 27, 28

McGraw-Hill Book Co. 106
Minneapolis-Honeywell ....2nd Cover

Nordberg Mfg. Co. 107

Ohio Brass Co. 96

Pennsylvania Transformer Div. McGraw-Edison Co. 14, 15
Phelps Dodge Copper Products Corp. 34, 35

Radio Corp. of America 41
Reliable Electric Co. ....3rd Cover
Revere Copper & Brass, Inc. 44
Reynolds Metals Co. 40
Riley Stoker Corp. 38, 39

Sangamo Electric Co. 92
Searchlight Section 111
Southern States, Inc. 4
Stearns-Roger Mfg. Co. 29

United States Rubber 16, 17
United States Steel Corp. 101, 102, 103, 104

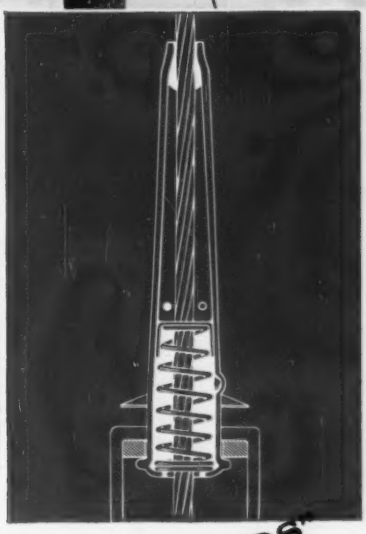
Wadsworth Electric Mfg. Co., Inc. 106
Wagner Electric Corp. 8, 9
Westinghouse Electric Corp. ...10, 11, 83, 85, 87
Wheeler Mfg. Co. Griscom-Russell Co. ....4th Cover

PROFESSIONAL SERVICES 111

CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES 111

EQUIPMENT (Used or Surplus New) For Sale 111



"Nothing beats those FEED-THROUGH DEADENDS"

We who make them can be pretty sure, too, because we can refer you to the record . . . During 27 years of continuing production, we have yet to hear that a Reliable Feed-Thru Deadend chuck let go a line!

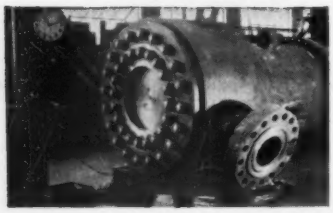
We recommend them for new construction, maintenance and . . you bet! for hot line work. They are fast, safe, sure. For most distribution sizes of ACSR, AAC, AAAC, copper, Alumoweld, Copperweld, steel strand.

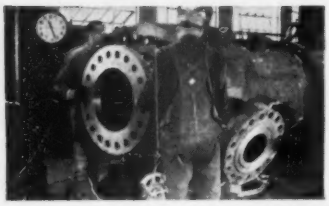
The price of time alone says you should check into mechanical type deadends.

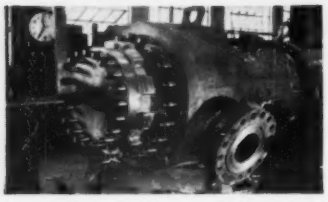
Reliable

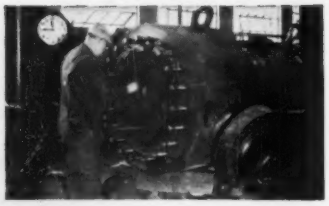
A Symbol of Integrity Since 1909

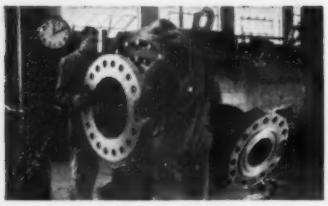
RELIABLE ELECTRIC COMPANY Franklin Park, Illinois

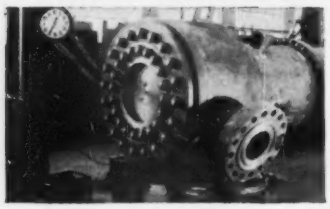




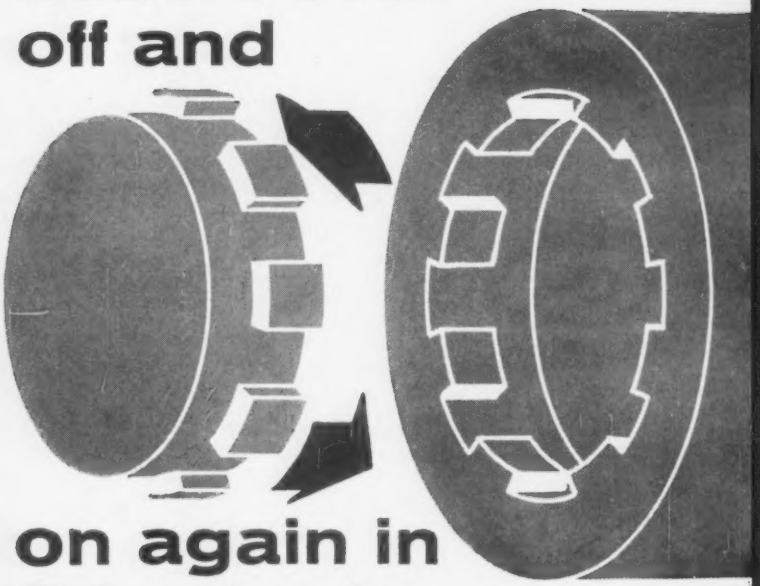








head cover off and



on again in 84 minutes

cuts feedwater heater inspection downtime

Periodic internal inspection of high pressure feedwater heaters is easy and fast with G-R Type "L" breech block heads. The complete operation of cover removal and reinstallation is shown in photographs at left.

When the cover is removed the entire tube sheet and all tube joints are readily accessible for examination and cleaning from outside the heater. No need to squeeze and squirm inside the water head whether heaters are large or small.

G-R Type "L" breech block high pressure heaters are available with all welded seals without gaskets, with rolled or rolled-and-welded tube joints.

More than 1,000 G-R heaters are installed operating at over 1,000 psi. More than 250 are in operation at pressures in excess of 3,000 psi. *This record is unsurpassed by any other American manufacturer.*

G-R high pressure heaters are available in all types and sizes, horizontal or vertical, and are furnished with suitable cover handling rigs.

Take advantage of G-R's extensive experience in the design and fabrication of Feedwater Heaters. There is a G-R representative in your territory ready to help you.

GRISCOM-RUSSELL / C. H. WHEELER

Massillon, Ohio — Philadelphia 32, Pa.

Affiliated sources for heat exchangers, closed feedwater heaters, deaerating heaters, evaporators, steam condensers, pumps, marine auxiliary equipment, sea water distillation plants, nuclear steam generators and related components.